RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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The Clinical Usefulness and Limitations of Supervoltage Roentgen Therapy[1]

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IT IS WITH DUE humility that we venture to discuss supervoltage roentgen therapy within the shadows of San Francisco and Berkeley. With the advent of newer forms of high-voltage accelerators, which seem to place no finite limits upon the energy of x-ray or particle beams, rays generated within the range of 1,000 kv. can now scarcely be classed as supervoltage. We make no apology, however, for attempting to evaluate our ten years of experience with radiation of this modest energy (1). In so doing we are brought face to face with the ever more striking fact that our biologic and clinical knowledge lags behind technical development by many orders of megavolts. It is now approximately twenty-six years since Coutard gave to roentgen therapy the status of an independent and useful art. His medium-voltage equipment, archaic by present standards, provided him with a tool which enabled him to make radiobiologic and clinical observations, obtaining results still rarely surpassed and infrequently equalled by those using modern apparatus.

It cannot be said that we as yet fully understand biologic effects and clinical application of x-rays within the range of 200 kv. X-rays within the range of 1,000 kv. have had clinical application for about fifteen years. Our own personal experience covers ten years. We have had the advantage in our own clinic of drawing upon the patients and records of our predecessor, Dr. John E. Wirth, who encountered some of the initial pitfalls in the use of supervoltage x-rays. Controlled clinical appraisal in the Tumor Institute of the Swedish Hospital, therefore, dates from 1935, covering a thirteen-year period.

APPARATUS AND TECHNICAL FACTORS

The apparatus which we have used consists of a General Electric KXC-2 installation, which was engineered in 1932, the pioneer period in the development of x-ray voltages of about 500 kv. The cascade banks of transformers and condensers and the operation of the tube (14 feet in length) in air necessitate a large shielded room to provide clearance between the voltage-generating apparatus. The system is now archaic in design when compared with modern apparatus; yet its performance has been remarkable. The time loss due to repairs and maintenance has not appreciably exceeded that of more conventional medium-voltage equipment.

Operational voltage has been maintained at 800 kv. as recorded by rotary voltmeter measurements (2). Provision for control-

[1] Presented at the Thirty-fourth Annual Meeting of the Radiological Society of North America, San Francisco, Calif., Dec. 5–10, 1948.

lable cathode bias (3) with the filament operating at 10 ma. produces a beam of effectively higher quality for a given applied potential. Filtration of 4.25 mm. lead in addition to secondary filters gives a beam of half-value layer equivalent to 3 mm. lead or 9.1 mm. copper. The effective wave length has an average value of 0.0245 Å. Target-skin distance is 100 cm. Cones are avoided by the interposition of a light-centering and field-defining mechanism, the beam traversing the last 30 cm. in air before striking the skin.

Dosage measurements have been made exclusively with Victoreen condenser r-meters. It has been standard practice to perform tube calibrations by measurements with the chamber half sunk in an untempered masonite presdwood phantom, thus including back-scatter in the measured surface dosage. Dosage rate for a field of 10 × 14 cm. under operating conditions is 24 r per minute. Surface dosage rate as a function of field size above 25 sq. cm. has a rather slow dependence on size. Depth dose measurements of typical values at 10 cm. (100 cm. F.S.D.) are:

	Per cent of Surface Doses	
	800 kv.	200 kv. (1 mm. Cu)
50 sq. cm.	47	31
80 sq. cm.	49	35
140 sq. cm.	53	39

Dosage measurements with multiple fields which are not co-planar, and especially with irregular contours, have been made with the aid of presdwood models.

PHYSICAL ADVANTAGES OF SUPERVOLTAGE ROENTGEN THERAPY

Initial enthusiasm for the development of x-rays at voltages in excess of 400 kv. arose from the possibility of obtaining an improved depth dose for the treatment of deep-seated tumors. Although such improvement is real, it does not in itself justify the operational cost of supervoltage equipment. The relatively small increase in depth dose between 200 and 800 kv., despite the greater penetration, is attributable to the greatly reduced scatter in tissue. This provides a more homogeneous beam throughout the irradiated volume and significantly limits the spread of the beam beyond its geometric confines. At a depth of 7 cm., with a medium-sized field, the dose for 800- and 200-kv. x-rays, relative to 100 per cent at the surface, is, respectively, 13 and 25 per cent 1 cm. outside the geometric beam. Corresponding values at 2 cm. displacement are 9 and 15 per cent.

The advantages derived from this more forward scattering are several.

1. The size of the field does not need to be increased in order to add to the scattered component of the depth dose. The size of the field is determined by the geometric size of the tumor.

2. Better beam definition is helpful in minimizing unwanted irradiation of normal or previously irradiated tissues. This is seen in the significant reduction of the x-ray contribution to the cervix, vaginal vault, and rectum when the parametria are irradiated in conjunction with intracavitary radium approaching the limit of tissue tolerance. Further irradiation of midline structures is purposefully minimized.

3. The efficiency of treatment, measured as a ratio of energy absorbed in a tumor to total energy absorbed by the body, is likewise an important advantage of the more sharply demarcated beam. It is this factor which to a large extent accounts for the improved tolerance of the patient to supervoltage x-ray therapy. It cannot be denied that radiation sickness is more rare and easier of control with radiation in the higher-voltage range. This is perhaps the most striking feature to one who has an opportunity to follow patients through major radiation therapy.

In Figure 1 is represented a tumor located more or less centrally in a body 25 cm. thick. Of the total energy absorbed by the patient, Parker calculates the following amounts absorbed by the tumor (4):

A (200 kv.)	5 per cent
B (800 kv.)	10 per cent
C (2,000 kv.)	11 per cent
D (ultra-high voltages)	12 per cent

For every unit of energy absorbed by the

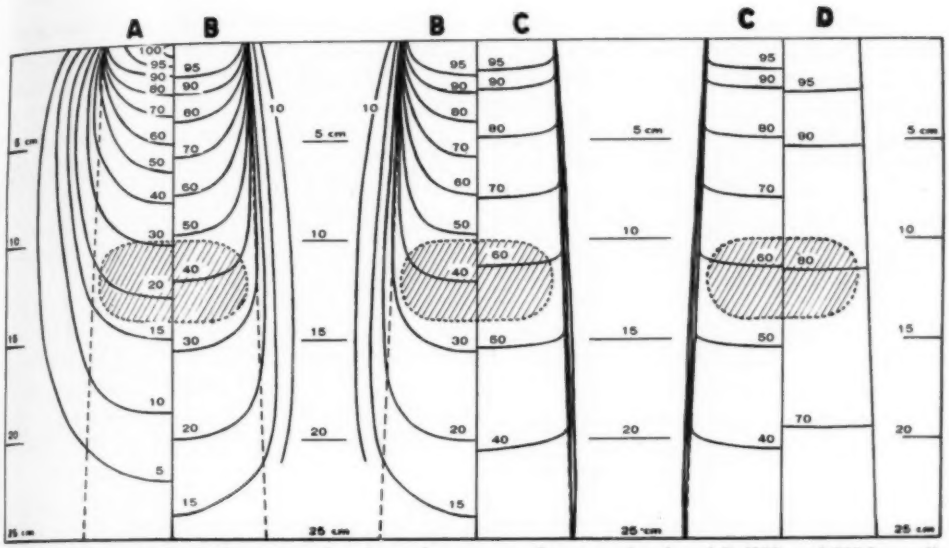

Fig. 1. Representative isodose curves in a large tissue mass. In comparing A and B (200- and 800-kv. radiation), note especially how the radiation in B is confined much more closely to the geometric beam (shown by the broken lines). This change is as important as the increase in depth dose.

The charts show the distribution of radiation through a plane containing the central axis of the beam. The incident field is a circle 7.5 cm. in diameter. Focus-skin distance is 100 cm. As usual, the curves show the percentage depth dose referred to 100 per cent at the center of the field on the skin surface.

A. 200-kv., constant potential. Filter 1 mm. Cu + 1 mm. Al.
B. 800 kv.p., grid-biassed pulsating potential. Filter 4.5 mm. Pb + Sn, Cu, Al.
C. 2,000 kv. nominal, *i.e.*, well filtered gamma radiation.
D. Hypothetical ultra-penetrating radiation.

The isodose curves have been split along the central axis and reassembled in pairs to make the successive changes in configuration more apparent. Reproduced from Supervoltage Roentgen Therapy (1) (H. M. Parker).

tumor, the total energy contributing to unwanted systemic effects will be 20 units at 200 kv. as opposed to 10 units at 800 kv. For more superficial tumors this advantage is offset by the increased undesirable radiation below the tumor.

4. Reduction in skin damage with 800 as compared with 200 kv. is due to two factors. The first is the more forward scattering, placing the sensitive layer of the skin, which gives rise to erythema, at a lesser depth than that at which secondary electronic equilibrium is established in tissue. This can be demonstrated by the addition of a layer of material of low atomic number to the skin, which places the sensitive skin layer at the equilibrium depth and increases the observed skin reaction. The second factor contributing to lesser initial skin reaction is in part the virtual absence of the photo-electric effect of the more energetic rays upon the considerably greater sulfur content of the skin as compared with other soft tissues (5, 6). This same diminution of photo-electric effect reduces the dose in bone, which is therefore primarily limited to the factor of increased density.

5. The combination of greater penetrability and lesser skin damage provides a favorable technic for utilizing only one field in the treatment of certain lesions where anatomic and biologic considerations permit. We have done this to advantage in the treatment of certain cancers of the pharynx and larynx, and even in extensive cancers of the lip, where penetrability is a less important factor than is a homogeneous beam devoid of the late sequelae which would accompany a multiple-field technic with medium-voltage radiation.

PHYSICAL DISADVANTAGES OF SUPERVOLTAGE ROENTGEN THERAPY

The physical advantages to be expected from x-rays in the range of 800 kv. having

been postulated, certain physical disadvantages are to be considered.

1. The cost of operation cannot be minimized.

2. Though present-day supervoltage apparatus has attained a flexibility not inherent in our older design, it is admitted that placement is not as easily or readily attained as with medium-voltage machines.

3. In using co-planar fields, one can theoretically offset the gain in depth dose by the increment of the exit dose upon opposing fields. Depending upon the size of field and body thickness, the exit contribution may be 10 to 25 per cent of the entrance dose. This can effectively reduce the central combined dose. In actual practice we have found, however, that the exit dose upon the skin is not the limiting factor. Injury to deeper normal structures forms the limiting barrier.

4. The physical advantages of increased depth dose and lesser skin injury could be offset by an adverse biologic effectiveness of the radiation. The threshold erythema for skin is in the range of 1,000 r for 800 kv. (h.v.l. 9.1 mm. Cu) as opposed to about 680 r for 200 kv. (h.v.l. 0.9 mm. Cu). The possibility exists of delivering at least twice the radiation at 10 cm. depth. If the tumor lethal dose increased in the same ratio, any advantage would be nullified. We have no clinical evidence that this is so. Experimental evidence in this energy range suggests that 200-kv. x-rays as compared to gamma rays with respect to lethal action on the roots of *Vicia faba* have an increased effectiveness of not more than 30 per cent (7). In so far as alterations in biologic effectiveness introduced by variations of wave lengths in the range under consideration are concerned, we would conclude that other factors are more important in deciding the outcome. The total irradiated volume, protraction, fractionation, clinical guidance of dose, and avoidance of undue injury to normal structures outweigh considerations of wave-length effect.

Further discussion of physical considerations will be omitted in favor of an emphasis upon clinical aspects of supervoltage roentgen irradiation. We have been most fortunate in having the collaboration of Dr. H. M. Parker in matters concerning physical and radiobiologic problems. More detailed analysis of the physical side of our work can be found in Parker's helpful contributions to our publications (1).

CLINICAL APPLICATION

Radiation therapy has sufficiently advanced in two and a half decades to permit us to delineate fairly well the indications and contraindications for irradiation in the more prevalent varieties of cancer. These indications depend primarily upon the biologic nature of the growth as expressed in its response to ionizing radiation. We likewise have experimental and clinical evaluations of the varying degrees of radiosensitivity of normal tissues. We are adequately familiar with the clinical course and avenues of spread of the more important cancers, together with the complications which may arise as a result of the natural history of the disease. In so far as roentgen therapy is concerned, this backlog of fundamental knowledge has accumulated through the painstaking observations of many workers who had at their disposal x-rays not exceeding 200 kv. in energy.

Paralleling this radiobiologic experience with medium-voltage roentgen radiation is the comparable information derived from work, both experimental and clinical, with the gamma rays of radium as the ionizing agent. In regard to biologic response of normal tissues and clinical indications for ionizing radiation, data gathered with the use of x-rays and gamma rays of radium were in general corroborative. Tissues and neoplasms had, generally speaking, the same sensitivity to medium-voltage x-rays as to gamma rays of radium. The indications for external irradiation were not altered when x-rays began to supplant teleradium, which historically was the initial source of the earlier clinical information. There were, however, certain observations made by those using large teleradium units which pointed to a possible technical advantage of radiation of shorter wave length.

These concerned the greater skin tolerance and the improved depth dose when a sufficient quantity of radium could be amassed in a single teleradium unit with adequate protection and beam localization. Teleradium was indeed the first supervoltage therapy unit. It supplies an adequately homogeneous radiation of 2 mev. and was limited in its further development only by problems relating to the scarcity (at that time) and cost of radium, the relatively low exposure rate, and adequate protection of patient and operator. The development of high-voltage x-rays was an attempt to overcome these disadvantages and yet obtain an instrument embodying the merits of the higher-energy radiation.

At this point it is of historic interest that, although x-ray therapy apparatus in the range of 1 mev. has been in clinical use for about fifteen years as a near imitator of teleradium, no one, so far as we are aware, has as yet used therapeutically x-rays of 2 mev., equivalent to the energy of the gamma rays of radium. The development of x-ray voltages above 1 mev. received great impetus during World War II, and such voltages were a useful tool in industrial radiography. It is only now, after the war, that apparatus capable of energies higher than 1 mev. is available for therapeutic use. With the advent of improved engineering in vacuum tubes, transformer and insulating design, with the elaboration of the Van de Graaff and betatron designs, one can choose his desired voltage provided he can circumvent one of the original disadvantages of teleradium—namely, cost. And then, to complete the cycle of events, we now hear rumblings that a mammoth telecobalt^{60} apparatus is envisaged as a supervoltage source par excellence.

Those who initially undertook the application of supervoltage x-rays to the treatment of cancer could not anticipate any startling improvement in curability in tumors which had not heretofore been amenable to medium-voltage therapy. Previous experience with gamma-ray therapy, and now with supervoltage x-ray therapy, has shown that in cancers which are not biologically responsive to ionizing radiation this inherent character will not change when the quality of the radiation is altered. Fibrosarcoma, osteogenic sarcoma, and melanoma have a similarly unfavorable response to 200- and 1,000-kv. x-rays. Gamma rays of 2,000 kv. have been no more effective. Likewise we cannot expect to alter, by improving the quality of the radiation, the grudgingly low level of response of otherwise radiosensitive tumors which have invaded bone or striated muscle. Epidermoid carcinoma which has involved the mandible is as hopelessly treated by supervoltage x-irradiation as by x-rays of lower energy. We have not found that epidermoid carcinoma in lymph nodes secondary to lesions of the lip or cervix are any more amenable to 800-kv. x-rays than they are to x-rays generated at 200 kv. The intestines do not tolerate any higher dose of supervoltage roentgen therapy than of x-rays in the lower range. The barrier to a more effective pelvic irradiation is not, therefore, lifted. Ischemia and previous irradiation to the point of normal tissue alteration are still deterrents to further effective therapy. Nor can we expect that addition to the operating potential in any way relieves the therapist from the task of careful daily clinical observation and the adaptation of the treatment to the tumor, the adjacent normal tissues, and the patient.

A critical evaluation, therefore, of any advantages to be found in supervoltage irradiation must realistically take into account the biologic limitations of x-ray therapy in general. Purely statistical reports which include a large number of hopelessly advanced cases, those which invade known barriers to control by irradiation, and lesions previously irradiated by other means, do not serve to clarify the possible small but significant place of supervoltage therapy in the management of cancer. The most that we can expect from radiation of higher voltage is some improvement in the results for those forms of cancer which are essentially radioresponsive to medium-voltage therapy.

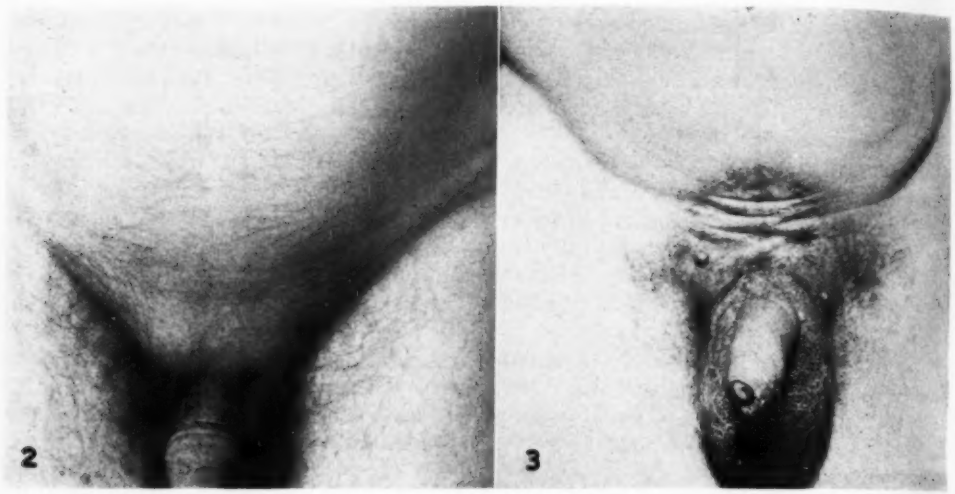

Fig. 2. Large multiple papillary carcinoma of bladder (Grade II), treated in 1941. Tumor dose through three fields, 4,300 r in fifty-nine days. Combined incident and exit dose to anterior field 5,200 r. Skin soft with central epilation. Posterior skin normal in appearance. Patient well, without urinary symptoms, in 1948. Reproduced from Supervoltage Roentgen Therapy (1).

Fig. 3. Advanced papillary carcinoma of bladder (Grade II), involving entire mucosa except dome, treated in 1935. Overtreatment. Tumor dose 10,000 r through four fields in sixty-three days. Combined incident and exit dose to anterior field 9,000 r. Skin and anterior abdominal wall densely fibrosed. Patient well thirteen years, with minimal bladder symptoms. Rectal fibrosis. Reproduced from Supervoltage Roentgen Therapy (1).

Our own material is statistically low in most categories of disease. This has not prevented us, however, from drawing certain tentative conclusions by the method of careful case analysis and personal attention to all the details of therapy. Although we might have derived statistical support or refutation for possible advantages of supervoltage therapy had we been able personally to conduct many more patients through their irradiation, we would not have had the time to accumulate the observations which are pertinent to our conclusions thus far. Mass production is not more successful in supervoltage than in medium-voltage therapy.

From the standpoint of clinical appraisal, two main divisions of disease are described. These are the deep-seated and the more accessible tumors.

Deep-seated Tumors: A rather wide variety of deep-seated tumors has been treated. Attention at this time will be given only to those of the urinary bladder, cervix, esophagus, and pituitary. These groups bring out the usefulness and hazards of supervoltage irradiation.

Between 1934 and 1942 a total of 61 *carcinomas of the bladder* were accepted for treatment. The majority of these were advanced postoperative recurrences and many of them would not now be accepted for therapy on the basis of our accumulated experience. Of the 61 patients, 9 have remained symptomatically and cystoscopically free of disease for more than five years. A more detailed analysis of these patients can be found in other publications (1, 8, 9). In most instances external irradiation is now given through three pelvic fields: a central anterior suprapubic and two lateral posterior fields with some degree of central angulation. It is possible thereby to obtain a tumor dose of 5,000 to 6,000 r in six to eight weeks without more than an initial bronzing of the skin and later incomplete epilation with very minimal subcutaneous fibrosis (Fig. 2). When the range of 5,000 to 6,000 r tumor dose is not exceeded, permanent rectal injury and reduced bladder capacity are not encountered. The reaction of the vesical mucosa characterized by frequency and urgency is anticipated, together with some degree of

radiation proctitis. One patient with an extensive papillary carcinoma involving almost the entire mucosa, treated in 1935, received a tumor dose approximating 10,000 r in sixty-three days. Although he has remained free of carcinoma of the bladder, late rectal fibrosis necessitated dilatation to prevent obstruction. A late breakdown of bladder mucosa healed without incident, and further urinary symptoms are minimal. The skin of the anterior field (Fig. 3), with dense underlying fibrosis of the abdominal wall, is in marked contrast to Figure 2.

We have learned primarily that the histologic variety of cancer of the bladder most favorable for roentgen therapy is the papillary carcinoma of a low degree of differentiation. X-ray therapy is usually considered in the more advanced cases or those with multiple recurrences after electroresection, when a choice must be made between cystectomy and irradiation. When invasion of the muscular wall of the bladder has occurred, the prognosis with x-ray therapy is less favorable. In only two patients with palpable infiltration outside the bladder, and with histologic evidence of invasion of bladder muscle, has control been achieved. It is essential that adequate drainage be established, by resection if necessary. Secondary infection due to urinary obstruction will result in failure, due to inability to progress with therapy. Although we have succeeded in controlling papillary carcinoma of the bladder with tumor doses below 4,500 r, we would consider this an inferior limit of safety and have in later years been able to deliver 5,000 to 6,000 r in six to eight weeks without undue complication. It is important to emphasize that with this quality of radiation the skin is not a guide to dose. The most vulnerable tissue in the field is the rectum. Nor is it likely that greater success will be obtained in sterilizing the papillary undifferentiated carcinomas by greatly increasing the tumor dose beyond the range of 6,000 r. The sessile invading epidermoid carcinomas will react poorly to a dose which can be administered safely by external irradiation. The very differentiated (Grade I) papillary carcinomas, in our experience, have not been permanently controlled nor has their reappearance elsewhere in the bladder been checked.

Roentgen therapy as an adjunct to intracavitary radium is still the most widely accepted procedure in the treatment of *cancer of the uterine cervix*. It was hoped that supervoltage irradiation would improve the survival rate in the more advanced cases with extracervical spread. Reliance is placed on local radium therapy for control of the primary disease. In some cases this is combined with transvaginal x-ray therapy because of infection, hemorrhage, or the presence of an exophytic growth complicating suitable radium placement. Our method of intracavitary radium therapy follows the general principles evolved by the Institut du Radium, Paris (10). Control of the local disease in the cervix is not the insurmountable problem. In 109 cases of Stages I and II treated between 1939 and 1945, we have seen no instance of failure to control the primary disease in the cervix. Nor have we seen an instance of failure to control the disease in the cervix in 55 cases of Stage III in which adequate radium therapy was possible, provided parametrial extension could likewise be controlled. The problem, therefore, is one of securing adequate irradiation of the extracervical tissues involved in the spread of the tumor.

The success thus far achieved by radiation therapy in cervical cancer is dependent largely upon the favorable anatomic possibility of concentrating the dose in the cervix and uterus without irreparable injury. These are thick muscular organs supporting irradiation in amounts many times over that tolerated by adjacent rectum, vaginal mucosa, bladder, and bowel. One is therefore led to a technic which avoids a uniform dose throughout the pelvis, yet utilizes the various tissue tolerances to their limit. Thus the cervix may safely receive 20,000 to 30,000 r, the underlying rectum will sustain 5,000 r, the paracervical tissues with their vulnerable vessels may necrose beyond the range 8,000 r, while the

intestines within the pelvis are the most vulnerable, rarely tolerating combined doses in excess of 4,500 to 5,000 r without later injury which may be fatal.

At 800 kv., with two anterior and two posterior pelvic portals of 80 to 140 sq. cm., with a central gap over the cervix and rectum, the lateral parametria receive about 3,000 r in a pelvis of medium size (23 cm. anteroposterior diameter). This is achieved when the skin dose per portal is in the range of 3,500 r in six weeks. The radium contribution adds 1,800 to 2,000 r in this extreme lateral zone. The combined dose of 4,500 to 5,000 r, achieved over a total period of about eight weeks, is in our experience the upper limit of safety if intestinal injury is to be avoided. We have reported elsewhere (1, 11) the calamities of intestinal necrosis which can arise when the depth dose potentialities of supervoltage irradiation are used without due regard for normal structures. These accidents occurred in the early period of its use, when the hazards were not fully appreciated. The experience has not been repeated in the past ten years.

Depth dose measurements made by Parker in a presdwood pelvic model indicate the diminished scatter to the central zone of cervix and rectum with 800 kv. as compared with a similar technic using 200 kv. The more forward scattering reduces by one-third the x-ray contribution to the central zone, the tolerance of which is reserved for local radium therapy.

The skin reaction seldom reaches the stage of moist desquamation and leaves little trace other than incomplete epilation. The general constitutional reaction to a protracted course of pelvic irradiation is minimal, relieving the patient and therapist of the complications attendant upon radiation sickness.

Our results are not statistically superior to those achieved by the Institut du Radium using a comparable radium technic and 200-kv. x-rays (1, 12). The predominant reason for failure is not inherent in the wave length of the x-rays but rather in the vulnerability of normal tissues within the pelvis which precludes further increment of dose. Since it is no longer a problem to deliver a dose within the pelvis in excess of that which can be tolerated, it is difficult to understand how x-rays with energies above 1,000 kv. will enhance survival in cancer of the cervix.

We shall discuss *carcinoma of the esophagus* only briefly, since we have elsewhere described our experience with that disease in relation to supervoltage x-rays (1, 13). Epidermoid carcinomas of the lower two-thirds of the esophagus are cancers which should theoretically be amenable to improved curability with supervoltage irradiation when spread to the regional lymph nodes or beyond has not already occurred. Histologically they are more frequently of moderate differentiation, similar to carcinoma of the pharynx. Extensive experience by Zuppinger, Strandqvist, and others, with medium-voltage x-ray therapy has demonstrated that in at least 50 per cent of cases sufficient regression of the tumor is obtained to re-establish the esophageal lumen. The patient dies twelve to twenty-four months later of mediastinitis or metastases.

With 200 kv. and multiple thoracic fields, it is usually not possible to introduce a tumor dose in excess of 4,000 r in six weeks. With 800 kv., using an anterior and a posterior field, it is easily possible to attain a tumor dose between 5,000 and 6,000 r in a comparable period. Skin doses of 6,000 r are readily tolerated, and the depth effect is sufficient to introduce 45 to 50 per cent of the surface dose into the middle of the esophagus. The two opposing fields likewise facilitate the localization of dose and permit the use of smaller portals when oblique direction through the thorax is avoided. In addition to these physical factors, the greater general tolerance for radiation of this energy is important in patients already in poor general condition. All of these factors should permit greater salvage in cancers of the esophagus.

Our own number of cases is unfortunately too small to permit us to demonstrate conclusively the theoretical advan-

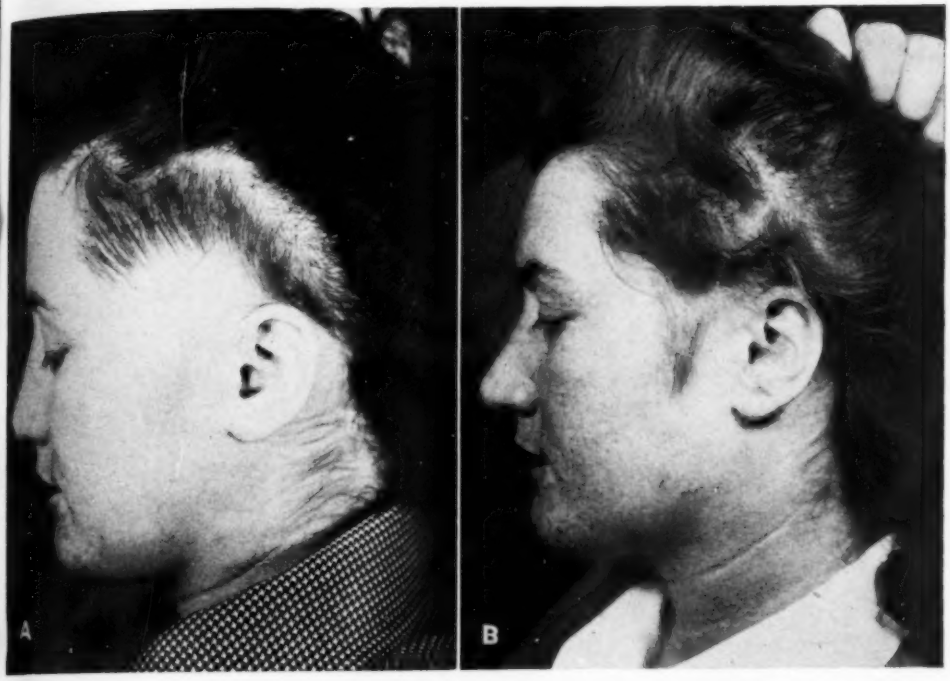

Fig. 4. Chromophobe adenoma of pituitary with sellar erosion and expansion; hemianopsia. Tumor dose 4,050 r in thirty-seven days through bilateral temporal fields 6 × 6 cm.
A. Epilation following therapy. Skin dose per field 4,650 r combined incident and exit dose.
B. Three months after A, showing regrowth of hair. Vision and clinical status satisfactory two years.

tages of 800-kv. irradiation. Since 1939 we have examined only 23 carcinomas of the esophagus, and only 8 of the patients were in sufficiently good general condition to support massive therapy. In all but one case an initial opening of the passage was obtained. In the one patient in whom we failed to re-establish the lumen, surgery later revealed a thick stenotic wall at the site of an esophageal ulcer previously demonstrated by fluoroscopy. There was no residual carcinoma in the esophageal wall at the level of stenosis, but cancer was later demonstrated at autopsy, higher in the esophagus, above the superior limit of the field. Of the 8 patients, only 1 remains symptomatically and radiographically free of disease eight years after treatment. The tumor dose in this case was 4,950 r. Another patient surviving four years, dying of cardiovascular disease (autopsy not obtained), received a tumor dose of 4,400 r. In the two patients in whom the tumor dose was in excess of 6,000 r, severe mediastinal and pulmonary fibrosis developed before eventual death from uncontrolled cancer.

These few observations to date encourage us in the hope that a careful application of supervoltage roentgen therapy may in time improve the control of esophageal cancer.

We shall include a brief discussion of *pituitary adenomas* treated by 800-kv. radiation. Between 1939 and 1946, we have treated 10 such tumors. Three were chromophile adenomas with progressive acromegaly; 2 of these patients are without evidence of progression of the acromegaly or other signs referable to pituitary expansion for periods of eight and three years. All 7 patients with chromophobe adenomas had marked radiographic changes in the sella, with deformity of the visual fields. In all patients a notable improvement of the visual fields was obtained. Five of the 7 cases are clinically stationary seven to

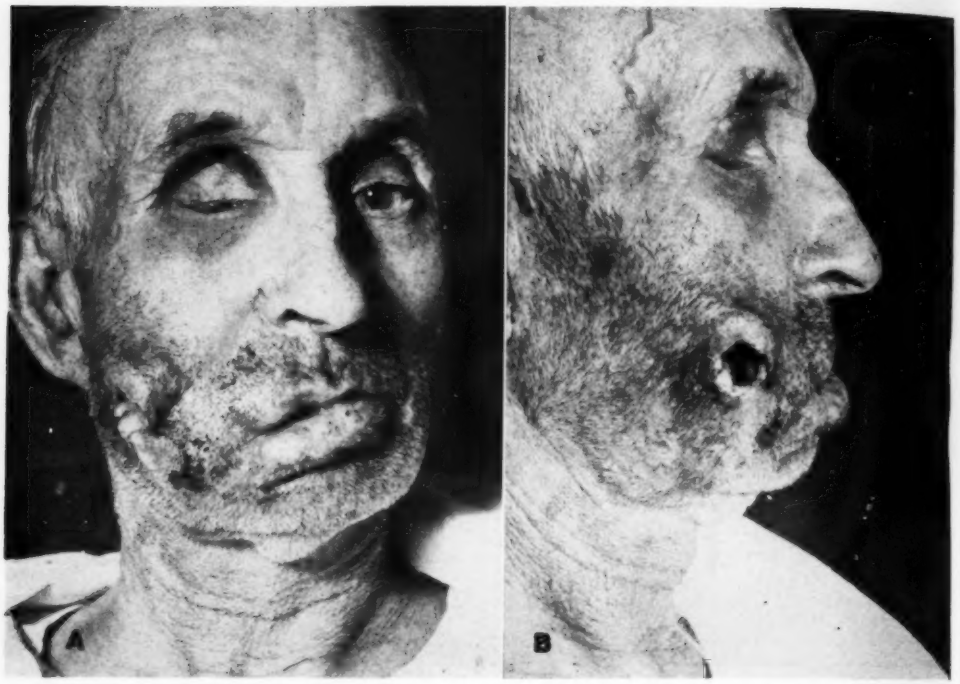

Fig. 5A-B. Advanced epidermoid carcinoma (Grade II) of buccal wall with deep central ulceration and fistula. Buccal tumor 6 cm. thickness. Mandible and maxilla intact. No palpable cervical lymphadenopathy. April 1941. Previous loss of eye from injury.
Roentgen therapy through right anterior, lateral, and posterolateral fields; combined dose through skin of right side 9,150 r in forty days. Estimated mid-oral dose 7,000 r.

two years after treatment. Two patients died of complications resulting from cystic degeneration, one following surgical intervention.

A recent report by Kerr (14) of the results of 200-kv. roentgen therapy in 50 cases of pituitary adenoma testifies to the usefulness of the procedure and the possibility of accomplishing the desired result in a high proportion of patients. We have used a technic similar to that advocated by Kerr, namely a single course of x-ray therapy directed to the pituitary, obtaining a tumor dose of about 4,000 r in five to six weeks. We have likewise avoided a technic which dilutes the dose by adding repeated small exposures over many months. This technic is not conducive to control in other forms of neoplasm, and we see no reason to expect that it will be more so with pituitary adenomas. Our tumor dose of about 4,000 r is perhaps somewhat higher than necessary in some patients. Kerr has preferred 2,400 r. This he accomplishes through four fields: two temporal, one frontal, and one vertical. Epilation is not permanent with an air dose of 2,000 r (h.v.l. 1.95 Cu) per field.

With bilateral temporal fields 6 × 6 cm., an incident skin dose per field of 3,500 r in six to eight weeks delivers 3,850 r to the hypophysis at 7 cm. depth. The skin dose is augmented by an exit contribution of about 25 per cent from the opposing field, resulting in a total skin dose of about 4,300 r. The reaction has not progressed beyond a bronzed desquamation. Epilation is not permanent (Fig. 4). The centering of the beam is facilitated by the use of two temporal fields. The volume of brain tissue irradiated with fields of 6 × 6 cm. is the minimum.

Accessible Cancers: In contrast to the deep-seated tumors, we have used super-

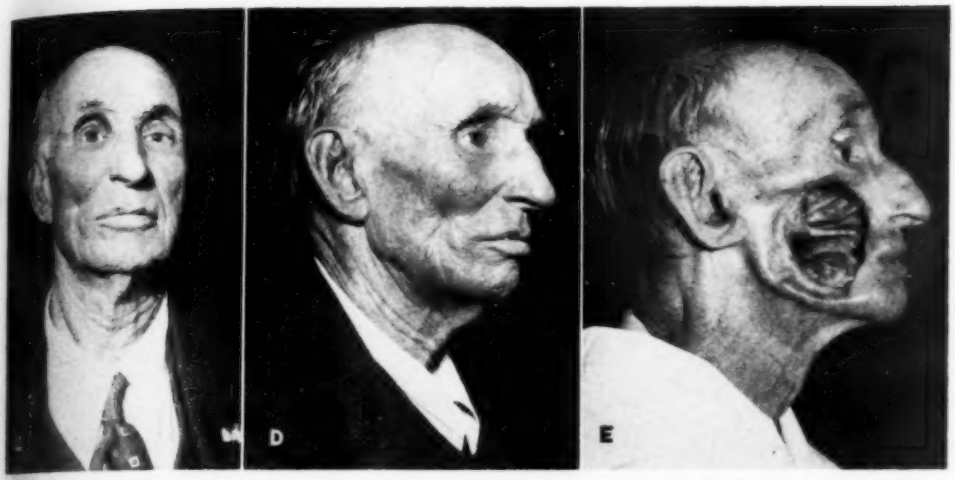

Fig. 5C–E. C and D. July 1941, five weeks after completion of therapy. Fistula closed; small remnant of ulceration of buccal mucosa; skin and cheek soft except about healed fistulous tract. E. Status in 1946. Patient was considered terminal in 1942, following slough of entire right buccal region, interpreted as uncontrolled cancer with necrosis. It was, however, necrosis only, due to excessive irradiation of a region unable to accomplish repair. Mandible intact. Patient living seven years.
Reproduced from Supervoltage Roentgen Therapy (1).

voltage roentgen therapy in a variety of the more accessible cancers. These include cancers of the pharynx, tonsil, base of the tongue, larynx, and the accessory nasal sinuses. Cancers of the oral cavity, including advanced cancers of the lip, have also been treated. The advantages anticipated arise from a well localized beam of penetrating radiation with a sufficiently low skin effect to permit irradiation through a single field when indicated. Any disadvantage results from unwanted irradiation of tissue beyond the tumor. With one field and supervoltage x-rays, the irradiation of tissue beyond the tumor may, however, be less than that resulting from the use of multiple fields and 200-kv. x-rays necessary to accomplish a comparable tumor dose. One must be careful, however, to exercise clinical judgment in the application of a single-field technic. Cancers of the nasopharynx, base of the tongue, tonsil, and epiglottis may metastasize to one or both sides of the neck. The use of one field on the side of palpable cervical metastasis involves the real danger of failing to treat existing but subclinical spread on the opposite side. When a single field is used, the skin of the face or neck will readily tolerate 6,000 to 6,500 r in four to six weeks. The late effect is a skin with little evidence of radiation injury other than epilation and, in some patients, a scarcely discernible smoothness, rarely with telangiectasis. A larger skin dose will lead to some degree of late fibrosis of the subcutaneous tissues. The inherent danger in this high skin tolerance is the temptation to increase the total dose in advanced cases in order to achieve control.

Necroses of bone or edema and necrosis of soft tissues may ensue several years after completion of therapy. Unless one learns to curb his enthusiasm for an instrument to which the skin initially reacts kindly, he will see catastrophe envelop patients whose cancer has long since disappeared (Fig. 5).

With the possible exception of carcinomas of the base of the tongue, our curability in other forms of epidermoid cancer of the head and neck has not exceeded that obtained by skilled medium-voltage irradiation. Judiciously applied with due regard for normal tissue tolerance and appreciation of the varying biologic response to irradiation of epidermoid carcinomas, supervoltage x-irradiation is, however, a useful tool.

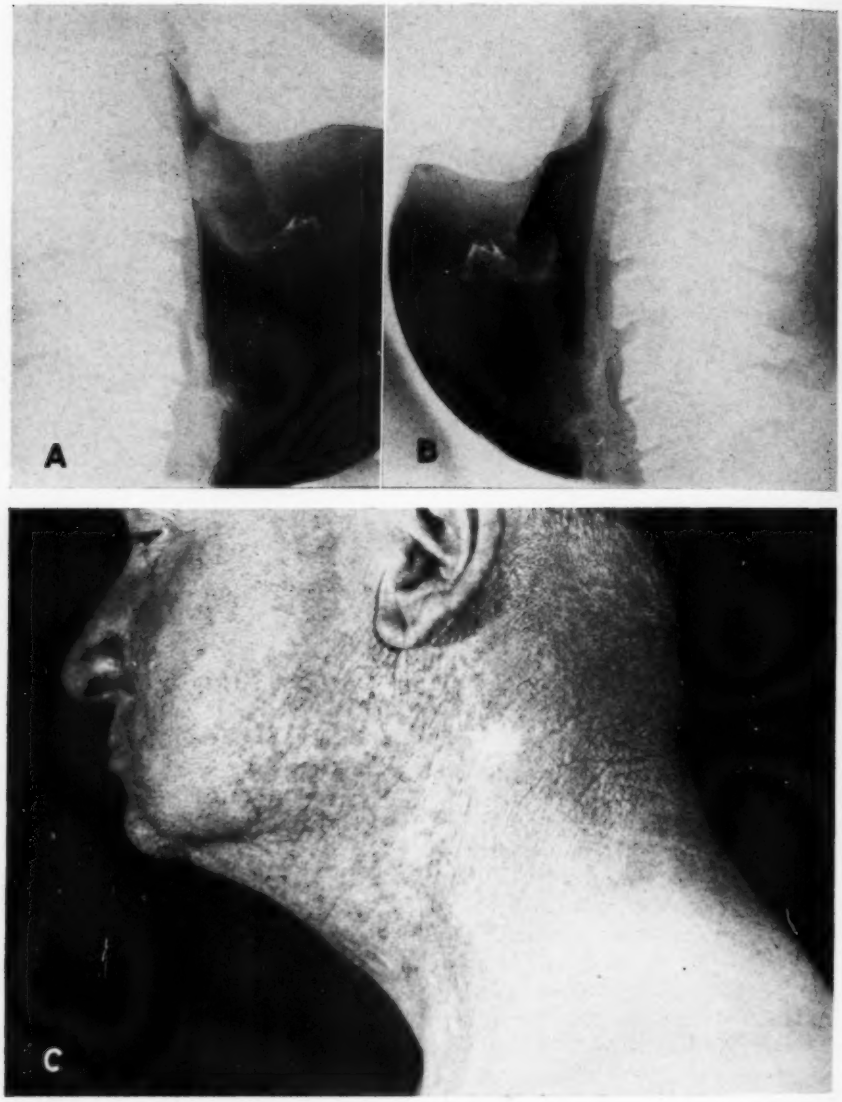

Fig. 6. A. Large anaplastic epidermoid carcinoma, left base of tongue, completely obliterating vallecula, as seen in lateral roentgenogram. Palpable lymph node 3 cm. in diameter at angle of mandible on left; 2 cm. in diameter on right. B. Restitution of vallecular space and normal contour of base of tongue following irradiation.

Roentgen therapy through a single left lateral field 10 × 14 cm., 6,100 r (skin) in twenty days, 1944.

C. Skin, in 1948, shows some mottled atrophy with minimal fibrosis. The small area of more intense atrophy represents a field treated three years previously for a basal-cell carcinoma of skin (3,500 r in five days, 120 kv., 3 mm. Al). There was no change in this localized area of atrophy during or following the massive irradiation directed to the base of the tongue. Patient well four years.

Reproduced from Supervoltage Roentgen Therapy (1).

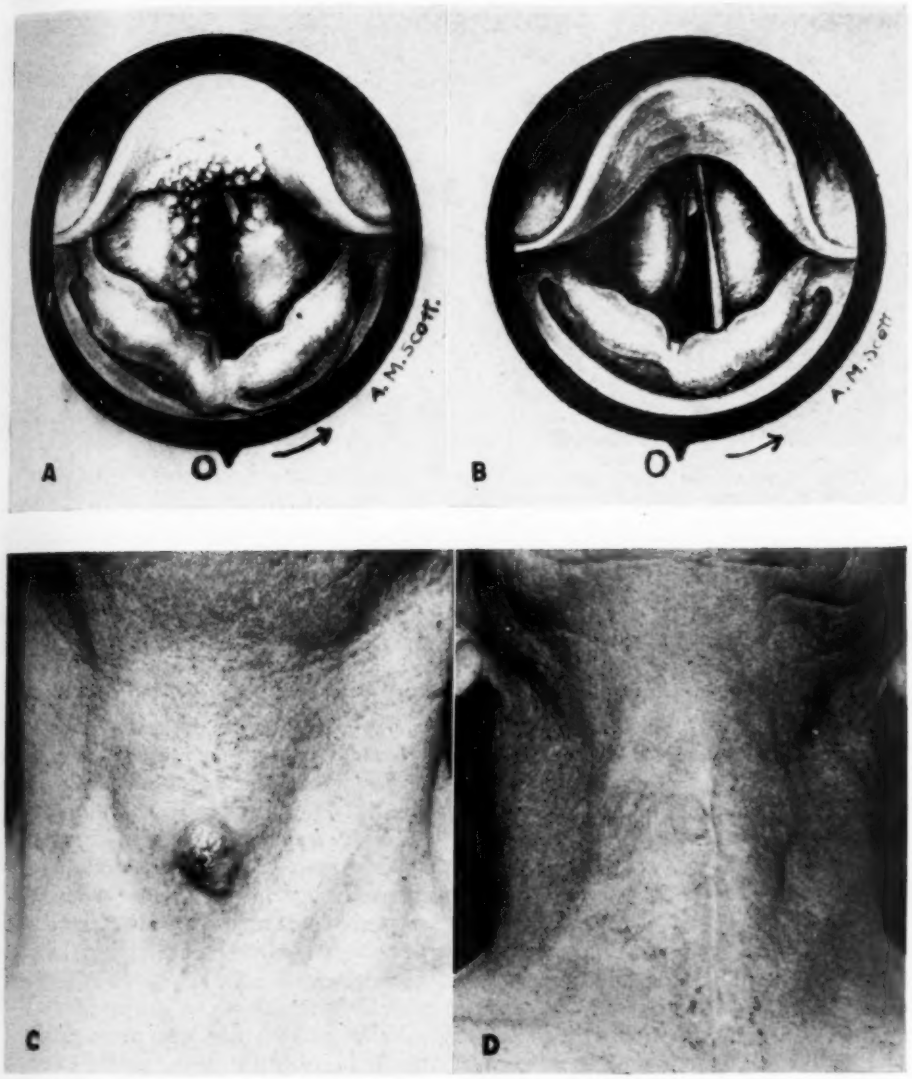

Fig. 7. A. Advanced undifferentiated epidermoid carcinoma of larynx following right cordectomy. Involvement of both false cords, commissure, and epiglottis, with extension through old tracheotomy sinus to appear as a mass in anterior neck. Status February 1939. See Fig. 7C.
B. Status of larynx in 1947.
C. Tumor of anterior neck by direct extension from larynx.
D. Status in 1947.
Roentgen therapy without tracheotomy. 5,175 r (skin) through a single field in twenty-nine days.
Reproduced from Supervoltage Roentgen Therapy (1).

Cancer of the base of the tongue may be either infiltrative or form a bulky mass filling the vallecula and metastasizing to cervical lymph nodes. Its prognosis has been notoriously poor. From 1939 to 1946 we have treated 6 cases, all well advanced. Thus far, 5 of the 6 patients are symptom-free for periods of seven to three years. Certain of these have been treated through a single field, admittedly hazardous from the standpoint of bilateral spread. Others have been treated through bilateral fields.

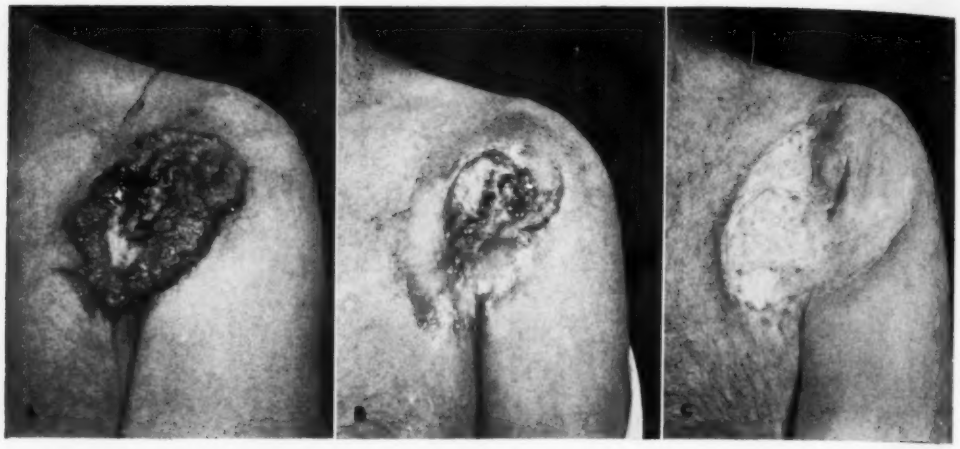

Fig. 8. A. Advanced epidermoid carcinoma of skin with central necrosis, October 1946.
B. Status in November 1947. Roentgen therapy, 6,600 r (skin) through a single field in thirty-seven days. Residual carcinoma.
C. Status in December 1948. Completion of treatment by excision and full-thickness grafts. It is of interest that, following this massive irradiation, the skin graft has healed and the area is soft. No palpable axillary lymphadenopathy.

Figure 6 is illustrative of the disease and result which may be obtained.

Cancer of the larynx, a relatively superficial organ, does not require 800-kv. radiation. Its adaptability to the management of laryngeal carcinoma is, however, seen in Figure 7.

Lastly, for the benefit of the skeptics, we add an example of advanced cancer of the skin treated by 800-kv. x-rays in combination with surgery (Fig. 8).

CONCLUSIONS

This brief account of the use and limitations of supervoltage roentgen therapy is amplified in a monograph now in course of publication (1). Our conclusions to date must be stated as tentative. We have had only ten years personal experience with the method. Our case material to date has been insufficient in certain categories of disease. In summary, however, we state the following conclusions:

1. For the great majority of cancers which are biologically amenable to radiation therapy, curative results with 800-kv. x-rays are not superior to those obtainable by skilled treatment in the medium-voltage range. In a small group of deep-seated tumors, as those of the bladder and esophagus, it is possible that supervoltage irradiation will be able to bring about an improvement in the survival rate.

2. Irradiation with 800-kv. x-rays is more tolerable for the patient because of the lesser skin injury and constitutional reaction, provided one intelligently respects the biologic tolerance of normal tissues.

3. The question of the importance of supervoltage apparatus as desirable equipment in a radiotherapeutic center can be answered by analogy. The situation is not unlike modern anesthesia. A skilled surgeon can in the great majority of patients successfully carry out major surgery with inhalation of ether. In a comparatively small number of cases, as for example in chest surgery, modern anesthesia has made a contribution to the ease of surgery and results. Similarly a good radiotherapist will obtain the same results with medium and with supervoltage therapy in the great majority of tumors which are biologically amenable to irradiation. With supervoltage irradiation he will be able to do so with a lesser morbidity in cases which require massive therapy. For a small group of malignant tumors, not exceeding about 10 per cent of all cancers to be treated, supervoltage irradiation may be a decisive factor

in curability. The choice of the optimal quality of radiation for the individual case depends upon a careful evaluation of all anatomical, biological, and physical factors.

4. From our experience with 800 kv. we would venture an opinion on the usefulness of x-rays of still higher energies. With 800-kv. irradiation it is possible to introduce within a tumor, regardless of the location, a dose which should be sufficient to control a malignant growth, in so far as the factor of dose alone is concerned. We have been able to introduce tumor doses in some locations which are double that generally considered necessary. The impossibility of controlling a great number of essentially radio-responsive tumors is not explained by technical difficulties of irradiation. The biologic limitations of normal tissue sensitivity are the limiting factors. Likewise the increase in x-ray energy does not alter the reaction of otherwise radioresistant tumors. I believe I am correct in stating that Dr. Robert Stone, in applying fast neutrons to cancer therapy, was even more confronted with the problem of a viable patient after he had successfully controlled the cancer. Such questions cannot be answered by theoretical considerations alone, and we would not wish to discourage careful investigators, who may disprove this opinion. It may be found that high-energy particle irradiation will circumvent certain of our dilemmas. We would only urge caution in these clinical experiments.

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SUMARIO

Utilidad Clínica y Limitaciones de la Roentgenoterapia de Sobrevoltaje

A base de diez años de experiencia con roentgenoterapia de 800 kilovoltios, se sacan las siguientes conclusiones:

1. En la gran mayoría de los cánceres biológicamente susceptibles a la radioterapia, los resultados curativos con rayos X de 800 kv. no son superiores a los obtenibles por el tratamiento adiestrado con voltajes medios. En un grupillo de tumores profundos, como son los de la vejiga y del esófago, es posible que la irradiación de sobrevoltaje pueda mejorar los coeficientes de sobrevivencia.

2. La irradiación de 800 kv. es más tolerable para el enfermo por ser menores la lesión cutánea y la reacción orgánica, con tal que se respete inteligentemente la tolerancia biológica de los tejidos normales.

3. Un buen radioterapeuta obtendrá los mismos resultados con la terapéutica de medio- y de sobrevoltaje en la gran mayoría de los tumores biológicamente tratables

con la irradiación. Con la de sobrevoltaje podrá hacerlo con menor morbidad en los casos que requieren tratamiento masivo. En un pequeño grupo de tumores malignos, que, aproximadamente, no forman más de 10 por ciento del total de cánceres por tratar, la irradiación de sobrevoltaje puede representar un factor decisivo en la curabilidad. La elección de la calidad óptima de irradiación en el caso dado depende de la cuidadosa justipreciación de todos los factores anatómicos, biológicos y físicos.

4. Con la irradiación de 800 kv. es posible introducir en un tumor, independientemente de su localización, una dosis suficiente para cohibir la proliferación maligna, en lo tocante exclusivamente al factor dosis. Los AA. han podido introducir en algunos sitios dosis tumor dobles de las consideradas necesarias generalmente. Las dificultades técnicas de la irradiación no explican porqué resulta imposible cohibir un gran número de tumores esencialmente radiosusceptibles. Los factores limitantes consisten en las limitaciones biológicas impuestas por la sensibilidad de los tejidos normales. Así también, el aumento en la energía de los rayos X no altera la reacción de los tumores por lo demás radiorresistentes.

DISCUSSION

J. Maurice Robinson, M.D. (San Francisco, Calif.): As I listened to Drs. Cantril and Buschke's conservative report on the end-results of their ten years experience with supervoltage x-irradiation in the treatment of cancer, I could not help thinking of the remark that one of our well known clinicians made: namely, that one was always well advised to use a new method of treatment as soon as it was described, because invariably, after about six months of use, it lost its magical properties. Perhaps there is no other way to explain the remarkable deterioration that has apparently taken place in the curative ability of rays which at one time apparently possessed such effectiveness that it permitted some of you to predict five-year cures after six months experience. Yet, according to the immutable laws of physics, corroborated by the latest reports of the science editor of the San Francisco *Chronicle*, these rays today possess the same physically measurable properties which they had fifteen years ago, when they first entered the radiotherapist's domain.

In 1940, Dr. Stone and I reported a series of experiments on comparative reactions to 200-kv. and 1,000-kv. radiations on the skin. A group of women with carcinoma of the cervix were treated over the lower abdomen and back through four 10 × 15-cm. fields, two anterior and two posterior. On the right side, we employed radiation of h.v.l. 1.0 mm. and on the left radiation of h.v.l. 9.5 mm. Cu, the one generated by 200 kv. and the other by 1,000 kv. The irradiation was protracted in the usual manner. We found that by a 25 per cent increase in radiation delivered to the skin by the 1,000-kv. x-rays, as measured by Victoreen air chamber, we were able to produce almost the same reaction that we had produced on the side treated with 200-kv. radiation. In calculating the increase, we considered the skin dose as a total of the air dose plus the back-scatter plus the exit dose, and this increase was divided up so that each treatment with the 1,000-kv. radiation included the 25 per cent increase in the number of r reaching the skin. The skin reactions were the same on both sides. The erythemas appeared at the same time after treatment was begun, developed the same depth of color, and receded at the same rate. Pigmentation appeared, developed, and faded at the same rate; blistering was about the same on the two sides; peeling was about the same, and the subjective symptoms were essentially the same. By this I do not mean that the patient had just as much nausea and diarrhea on one side as on the other, but that the patient was as nauseated and had about as much diarrhea after the 1,000-kv. treatment as after the treatment at 200 kv. Drs. Stone and Low-Beer have had the opportunity to follow up these patients and they seem to be in agreement that, even though the original reactions were about the same, at the present time there is more thickening of the skin, more subcutaneous fibrosis, and in some instances more telangiectasis on the side treated with 200-kv. radiations than on that treated with 1,000-kv. radiations. Dr. Low-Beer, who is more enthusiastic about supervoltage radiation than Dr. Stone, seems to feel more fibrosis and see more telangiectasis than Dr. Stone.

No doubt at that time some radiologists had been giving supervoltage therapy using air doses as the basis of comparison—and perhaps still are. Naturally their patients were receiving much smaller doses with 1,000-kv. radiation due to the relative absence of back-scatter, even when a greater number of treatments were given, because this means more protraction of the dose.

Be that as it may, I believe that all of us now are in essential agreement that there are definite advantages in the use of supervoltage radiation, both on the skin and in the depths, which have

nothing to do with a specific biologic dependence on wave length, and Drs. Cantril and Buschke have discussed these in some detail.

The increased effectiveness of the radiations generated at the higher voltages is primarily due to their ability to deliver an adequate dose to the tumor without involving the normal tissue in unnecessary irradiation by scatter. The most attractive feature of such high-voltage irradiation is the ability to employ a minimum number of fields, even one field, so that the normal tissues of the opposite side are preserved; and, of course, treatment is simplified greatly. The experience of Dr. Cantril and Dr. Buschke indicates that supervoltage does not increase the percentage of cure more than 10%. However, the lesser morbidity and the lesser destruction of the normal tissues are of themselves of considerable benefit, especially when we remember that in many instances we are not really treating the patient for cancer that he has, but for cancer that we think he has. We are not at all certain in some cases that patients with carcinoma of the cervix would not do as well if they received no x-irradiation at all. I am sure that we have perforated bowels with supervoltage radiation when the cervical cancer had probably been adequately taken care of by radium alone, but because there is no way for us to be certain of this in advance, we must include these patients in the group that receive external irradiation.

Certainly, it is desirable to use that radiation which will cause the least destruction to normal tissue, provided it is as effective in curing the cancer; and any radiation harder than that of h.v.l. 1.0 mm. Cu (*i.e.*, 200 kv. pulsating, 0.5 mm. Cu filter) shares in this superiority to some degree because it happens that back-scatter is greatest in the 200-kv. range, and consequently the skin effect is greater.

Even at h.v.l. 3.0 mm. Cu, which is attainable with 250 kv. constant potential, there is a decrease in back-scatter of 15 per cent for areas of 400 sq. cm., and the improvement in this regard continues into the supervoltage range, as we have seen, so that the skin effect becomes of less and less importance, the introduction of an adequate dose with the tumor becomes relatively simple, and the problem of preservation of the normal tissues becomes paramount. This last problem has not as yet been solved satisfactorily, even by supervoltage, as we have heard today.

I believe Drs. Cantril and Buschke are to be congratulated on a definitive evaluation of supervoltage therapy as practised today, and I wish to thank them for the opportunity to discuss their excellent paper.

Leo M. Levi, M.D. (Los Angeles, Calif.): With the members of the Radiological Society of North America assembled in this state, it seems only fitting to point out to them that the *first* x-ray equipment to be operated at potentials over 300 kv. was constructed by Dr. Charles C. Lauritsen and his associates at the California Institute of Technology in Pasadena.

In the latter part of 1930, a clinical study was begun to determine the effect of the radiation thus produced, *i.e.*, at 900 kv., on inoperable carcinoma, and it has been extremely interesting to hear what Drs. Cantril and Buschke have had to say as to the usefulness and limitations of supervoltage roentgen therapy.

The opinions expressed by our two distinguished colleagues impress me as being very carefully considered and extremely modest. They make no claims for any outstanding advantages in the use of the modality which they are fortunate enough to control. No unique or unusual superiority is claimed. They dispassionately state the known disadvantages as well as the possible advantages of their 800-kv. installation. Quite properly, they repeatedly emphasize that "the biologic limitations of normal tissue sensitivity are the limiting factors." They further point out that cancers which are not biologically responsive to ionizing radiation will not change in respect to this inherent character when the quality of radiation is altered. In other words, they imply that the radiosensitivity of the tumor does not similarly increase with the elevation of the voltage. Conversely, the vital and vulnerable normal tissues affected by the radiation do not acquire any increased tissue immunity thereby. To put this more simply, an increase in the voltage of the therapy machine does not increase the sensitivity of the tumor being treated nor does it grant an increased immunity to normal structures which stand in the unenviable position of innocent but nevertheless highly vulnerable bystanders.

In 1937, before the Fifth International Congress of Radiology, in Chicago, we reported clinical observations in the treatment of cancer by supervoltage therapy. The report covered about 800 cases. At that time (1937) we said that we had seen "irreparable damage to the bladder and rectal mucosa even though there was no striking cutaneous reaction." This paper was published in RADIOLOGY in April *1938* (Mudd, Emery, and Levi: Radiology **30:** 489, 1938). Nevertheless, in *1941* a book was printed in which the author quoted us as saying that "no serious complications" had been observed. Nothing could be further from the truth. Drs. Cantril and Buschke are to be congratulated and profoundly thanked for again calling to the attention of radiologists everywhere that skin damage is no longer a limiting factor in the use of x-ray therapy, and that the biologic tolerance of the normal tissues is the one thing that must be intelligently respected. Happily, they have emphasized not only the unlikelihood of any miraculous results to be obtained from equipment operating at voltages of two mil-

lion or more, but also the extreme caution which should be exercised in their possible employment. It appears that the ancient adage, "*festina lente*" still holds true. In other words, in dealing with an as yet unexplored modality, we must make haste very, very slowly.

The Britisher, Crother, has written: "Variations in wave length within the therapeutic range do not produce qualitative differences in cellular response. The character of this response is determined by the amount of radiation absorbed, the intensity of the radiation, and the area exposed."

As Dr. Stone has repeatedly warned us, radiologists must be constantly on the alert against premature acceptance of new methods. He said in the Janeway Lecture (Am. J. Roentgenol. **59:** 771, 1948): "Anyone contemplating the use on patients of new radiations such as multi-million volt protons, beta rays, and roentgen rays should study the relative biological effectiveness of them by late reactions as well as by acute early ones."

The authors of this afternoon's paper have closed their discussion on a note of caution. All that remains for me is to felicitate them on their results and to thank them for their admonition.

Maj. Keene M. Wallace, M.C. (Washington, D. C.): I think we can all agree that Drs. Cantril and Buschke have presented a very careful and conservative analysis of their experiences with supervoltage roentgen therapy. I would like to mention several advantages which we believe are offered by this type of treatment, in addition to those discussed in the paper.

It is our opinion that supervoltage radiation can achieve results not otherwise obtainable in advanced cervical carcinoma. Last year Dr. Friedman reported to this Society our experience with this type of lesion. Seven of 11 patients with advanced or recurrent cervical carcinoma treated with million-volt x-rays only were free of disease after four years or more. We have a strong feeling that supervoltage irradiation alone may play an all-important role in the treatment of advanced cancer of the cervix.

The pituitary adenoma is an ideal type of lesion for supervoltage treatment. The use of small portals reduces the volume of normal tissue subjected to irradiation. Small portals (5 × 5 cm.) are made feasible by the use of higher-energy radiation in that the relative increase in depth dose over 200 kv., with a similar sized field, is increased as much as 20 per cent. There is a risk in the use of multiple small fields with an inflexible apparatus because of the difficulty in aiming the beam. However, when a completely flexible machine, such as the Walter Reed type unit, is used, the beam can be easily and accurately aimed and one can utilize an important advantage of supervoltage, namely, small fields. In our group of 30 pituitary tumors which have been followed for three to five years, there were only 3 failures which necessitated surgical intervention.

Our experience in the treatment of brain tumors is more favorable with supervoltage than with 200-kv. therapy. This group of cases will be reported before the Eastern Radiological Society early in the coming year.

Finally, in the group of radiosensitive tumors, such as seminoma, lymphosarcoma, and Hodgkin's disease with large masses deep in the chest or abdomen, it is possible to achieve an adequate tumor dose in a much shorter time than with lower-voltage x-rays. This can be done with no appreciable increase in discomfort to the patient and it does shorten his period of debility and hospitalization. This point can be considered of economic value in a large general hospital, where a rapid turnover of beds is of considerable importance.

In justifying the cost of the supervoltage therapy installation, I would like to mention Dr. Cantril's conclusion, in which he states: "For a small group of malignant tumors, not exceeding about 10 per cent of all cancers to be treated, supervoltage may be a decisive factor in curability." If curability of only one type of cancer can be increased by the use of supervoltage therapy, the increased cost would seem to be warranted.

The large experience of Dr. Cantril and Dr. Buschke further substantiates the important role of supervoltage radiation therapy in the treatment of malignant diseases, and they are to be congratulated on their valuable contribution to this field.

Roentgen Therapy for Pituitary Adenoma

Correlation of Tumor Dose with Response in 64 Cases[1]

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THERE IS GENERAL agreement that pituitary adenomata are frequently responsive to radiotherapy. Since the publications by Gramegna (1) and Béclère (2) in 1909 numerous articles have appeared concerning the favorable action of roentgen rays on pituitary adenomata of all three types. A review of this literature shows that there is a wide variation in the method of giving roentgen therapy. The more commonly employed technics have involved the use of multiple courses of comparatively small doses given at long intervals. The reports have also shown considerable variation in the incidence of successful results.

Our own material includes cases which have been treated with roentgen rays by a large variety of technics, and with wide range of total estimated dose delivered to the pituitary. Because of this variation in methods of treatment, it was felt that an analysis of the results with respect to the therapeutic technic and total dosage might yield data suggesting an optimal procedure.

The material available for analysis includes 64 cases of pituitary adenomata. Of these, 38 were chromophobic, 21 eosinophilic, and 5 basophilic. The clinical syndromes of these three types of adenomata have been repeatedly described in numerous publications and will therefore not be discussed here. In all cases the diagnoses were established prior to treatment by groups of competent internists, neurologists, ophthalmologists, and radiologists. There were occasional instances, as also reported by others, where different tumors so closely simulated the syndrome of chromophobic adenoma that they were mistakenly treated as such. Only after failure of roentgen therapy, at surgical intervention or postmortem examination, was the true character of the process established. Thus, we had one case of intrasellar meningioma, one case of paraphysial cyst of the third ventricle, and two cases of Rathke pouch cysts without calcification. These 4 patients have been excluded from the series. Such cases of mistaken diagnosis occur in only a very small percentage of the patients with a clinical diagnosis of pituitary adenomata. The proportion is so small that the errors do not significantly alter the improvement rates following radiotherapy. Confirmation of the diagnosis of pituitary adenomata was obtained in 16 of our cases either by surgery or at postmortem examination.

Radiotherapy was the primary method of treatment in 61 of the 64 cases. In 13 of these 61 patients, surgery was later performed. Three cases were first treated surgically and were given radiation therapy for postoperative recurrence.

The technics employed in treating this series of cases varied mainly in the total dosage delivered, the number of courses given, the treatment period for each series (in days) and the over-all time for the multiple courses (months to years). The physical factors of irradiation were comparatively uniform. They were: 180 to 200 kv.; 0.5 mm. Cu and 1 mm. Al to Thoraeus filtration; h.v.l. 0.9 to 2.0 mm. Cu; target-skin distance 50 to 60 cm. Usually three pituitary fields were employed: frontal and right and left temporal. The field sizes varied from a circle 5.0 cm. in diameter to a rectangle 6 × 8 cm. Occasionally parafrontal, superior, and mastoid fields were employed. These latter were used particu-

[1] Presented at the Thirty-fourth Annual Meeting of the Radiological Society of North America, San Francisco, Calif., Dec. 5–10, 1948.

TABLE I: PITUITARY ADENOMATA: AGE AND SEX INCIDENCE OF 64 CASES

Type	Number	Sex		Age Incidence					
		Male	Female	10–19	20–29	30–39	40–49	50–59	60–69
Chromophobe	38	20	18	1	3	11	13	5	5
Eosinophilic	21	7	14	1	2	8	8	2	0
Basophilic	5	0	5	0	3	2	0	0	0

larly in cases requiring considerable retreatment. In each case the dose to the pituitary was estimated, and only these tumor doses have been utilized in the various evaluations of radiation effect.

The distribution of the cases as to age and sex is shown in Table I. The chromophobic and acidophilic adenomata were most commonly observed in the fourth, fifth, and sixth decades. No significant sex difference was noted in the patients with chromophobic and eosinophilic adenomata. All five of the basophilic adenomata were in females. This distribution is quite similar to the findings recorded by other investigators.

In 11 of the cases which received radiotherapy, the adenomata were available for study following partial surgical excision or at postmortem examination. The pathological material was reviewed by Dr. Joseph H. Globus, neuropathologist to the Mt. Sinai Hospital. While changes which might be interpreted as somewhat regressive were occasionally observed, in no case was there complete disappearance of the tumor or characteristic marked radiation effects. In most instances the microscopic appearance was the same in the treated as in untreated cases. The dose given to these treated cases varied up to 2,600 r in one series, and the time of microscopic examination ranged from three months to several years following irradiation.

Clinical evaluation of the result of roentgen therapy offers some difficulty, since sharply defined criteria (such as the complete disappearance of the tumor in the treatment of carcinoma) are not available (3). The best objective test of improvement is the widening of visual fields and increase of vision. In the case of eosinophilic adenomata, decrease of acromegaly also constitutes important evidence. With the basophilic adenomata, loss of weight, diminished blood pressure, restoration of a normal sugar-tolerance curve, etc., are good objective indications of satisfactory therapeutic effect. In none of the cases have we seen an enlarged sella decrease in size, or demineralized clinoids show evidence of recalcification following therapy. Optic atrophy of varying degree was found in 22 of the 64 cases. Despite improvement of vision and enlarged visual fields following therapy in a considerable percentage of these patients, in no case did the pallor of the disks disappear. Evaluation of such important subjective complaints as severe headaches, fatigue, vertigo, and blurring of vision is somewhat more difficult. However, when improvement occurs, the amelioration of these symptoms is so definite as to form an integral part in the estimation of its degree.

With the criteria described above, it was found that the effect of radiation could be divided into four rather distinct categories with reasonable accuracy. These categories have been used throughout the analysis of the material. They are as follows:

1. Marked improvement: A marked beneficial change in the course of the disease, with restoration of the patient to an almost normal status.

2. Moderate improvement: A moderate but definite beneficial change in the course of the disease. This group includes those patients with a slowly progressive disease who show definite regression of symptoms following therapy, and those patients with a rapidly progressive process in which the course of the disease is arrested.

3. Doubtful: No marked change in the course of the disease. In this category are included those cases with slowly progressive disease whose status remains more or less

TABLE II: OVER-ALL RESULTS WITH RADIOTHERAPY FOR PITUITARY ADENOMATA (64 CASES)

Chromophobic Adenomata (38)

Immediate Satisfactory Results		19	Immediate Unsatisfactory Results		19
Remained improved	16		No further treatment	2	
Recurrence	3		Surgery only	6	
Retreated	3		Retreatment	11	
Satisfactory	3		Unsatisfactory	8	
			Satisfactory	3	

X-Ray Final Result: Satisfactory.....22 (57.9%)
Unsatisfactory 16 (42.1%)
Follow-up: 6 mo.–12 yr., Av. 4.1 yr.

Eosinophilic Adenomata (21)

Immediate Satisfactory Results		8	Immediate Unsatisfactory Results		13
Remained improved	7		No further treatment	4	
Recurrence	1		Retreatment	9	
Retreated	1		Unsatisfactory	8	
Satisfactory	1		Satisfactory	1	

X-Ray Final Result: Satisfactory..... 9 (43%)
Unsatisfactory 12 (57%)
Follow-up: 6 mo.–14 yr., Av. 4.8 yr.

Basophilic Adenomata (5)

Immediate Satisfactory Results		4	Immediate Unsatisfactory Results		1
Remained improved	3		Retreatment	1	
Recurrence	1		Unsatisfactory	1	
Retreated	1				
Satisfactory	1				

X-Ray Final Result: Satisfactory.....4
Unsatisfactory 1
Follow-up: 6 mo., 2½ yr., 4 yr., 10 yr.

unchanged following the treatment. Also included are those cases with more rapidly progressive disease in whom only mild temporary beneficial results are noted.

4. No effect.

The term "satisfactory result" includes the two categories "marked" and "moderate improvement." The term "unsatisfactory result" includes those patients showing "doubtful" and "no effect."

Table II shows the over-all results of the radiation therapy administered in our 64 cases. In this table no attempt has been made to differentiate the results with respect to method or quantity of radiation. Of the 38 patients with chromophobic adenomata, 19 (50 per cent) showed satisfactory improvement following the first course of x-ray therapy. Of the 19 who failed to respond, 11 were retreated by radiation. Of these latter, only 3 showed a satisfactory response. There were 21 cases of eosinophilic adenomata, 8 (38 per cent) of which responded satisfactorily to the first course of therapy. Thirteen cases failed to benefit. Of these 13, 9 were retreated, and only one responded satisfactorily. Thus, the percentage of satisfactory results following the first course of radiotherapy appears considerably higher than that following retreatment where the first course had failed. Statistical analysis of this difference of percentage shows a distinct trend toward significance.[2]

Of interest, also, was our finding of a somewhat greater percentage of satisfactory results in the chromophobic adenoma group than in the eosinophilic series. This difference did not prove to be of definite statistical significance for the number of cases involved.[3] These findings are at some variance with those of other observers, who report the opposite trend (3, 4, 5).

Of the 5 cases of basophilic adenomata, 4

[2] The "Chi-square" test of significance of difference between ratios applied to the chromophobic adenomata group yields a P of 0.18; for the eosinophilic group, 0.15; and for the numerically larger combined groups of chromophobic and eosinophilic adenomata P = 0.08.

[3] The "Chi-square" analysis yielded a P of 0.28, which means that there is a chance probability of 28 per cent that such a variation could be observed in a basic population in which the eosinophilic and chromophobic adenomata respond equally well to radiation. However, the probability of a chance occurrence of our observed distribution in a basic population wherein eosinophilic adenomata respond better than basophilic adenomata decreases considerably below 0.28.

TABLE III: IMMEDIATE RESULT FOLLOWING FIRST COURSE OF IRRADIATION IN CHROMOPHOBIC AND EOSINOPHILIC ADENOMATA

Clinical Response	Tumor Dose			
	0–999 r	1,000–1,999 r	2,000–2,999 r	3,000 r and Over
Chromophobe adenomata				
Marked improvement	0	2	4	1†
Moderate improvement	2	4	5	1
Doubtful	2	3	0	0
None	4*	7**	2*	1‡
Eosinophilic adenomata				
Marked improvement	0	1	2*	1
Moderate improvement	1	2	1	0
Doubtful	1	3	2	0
None	5	2	0	0

* Each asterisk represents one case of cystic adenoma.
† Result due at least in part to surgery.
‡ Questionable carcinoma of the pituitary. Marked bony destruction of middle fossa.

showed a satisfactory response to radiation therapy. This relative radiosensitivity of basophilic adenomata has also been noted by Luft (6).

Patients showing satisfactory improvement were followed for varying periods of time. The shortest follow-up period was six months and the longest fourteen years. The average follow-up period for the entire series was 3.9 years and the standard deviation 3.9 years.

There were 5 cases of cystic adenomata encountered (7.8 per cent). Of these, 4 were chromophobic and failed to respond to radiation. Subsequent surgery was required. These findings further support the general impression that the cystic lesions are not amenable to radiotherapy (3, 5, 7, 8, 9). The fifth case was exceptional, a cystic eosinophilic adenoma which received a tumor dose of 2,350 r in twenty-nine days. There was an immediate satisfactory response with considerable regression of the acromegalic manifestations. The patient had no further complaint referable to her pituitary lesion. Five years later she died suddenly in acute congestive heart failure due to active rheumatic carditis. Autopsy revealed a cystic, probably eosinophilic adenoma. The chromophilic granules were rather poorly staining.

Table III shows the relationship between the tumor dose and the immediate result following the first course of radiation. It is clearly evident from this table that the percentage of chromophobe cases showing satisfactory clinical response significantly[4] increases with the dosage. Tumor doses up to 1,000 r are definitely unsatisfactory. Only 2 out of the 8 cases receiving this amount of radiation showed a satisfactory improvement.

The results are better in the cases receiving 1,000 r to 1,999 r. Six of the 16 cases receiving this dosage responded well. The best results have been obtained in the group receiving between 2,000 and 2,999 r; 9 of the 11 patients improved satisfactorily. Only 3 cases received 3,000 r or more to the pituitary in the initial course, and this number is too small to permit conclusions.

The eosinophilic cases show a similar but less marked improvement of the results with increasing initial tumor doses up to 3,000 r. The number of cases is smaller and the findings are slightly less significant statistically.

Of the 5 patients with basophilic adenomata, 2 received tumor doses of 1,260 r and 1,080 r in their first series. In both of these patients results were unsatisfactory. The remaining 3 cases received 1,510 r, 2,240 r, and 2,770 r. In each of these instances there was marked improvement.

Multiple course technics with comparatively small doses per course are commonly employed in radiotherapy for pituitary adenomata, and have been used by us in the treatment of many of these cases. The additional courses were given either because they were considered as part of the

[4] Applying the "Chi-square" test to the chromophobic cases only, the probability of such a distribution of results due purely to chance is 0.05, a level considered as statistically significant. When the data are grouped to increase the size of the individual cells by considering the "marked improvement" and "moderate improvement" cases as a single "satisfactory" group, and the "doubtful" and "no effect" categories as a single "unsatisfactory" group, the probability diminishes to less than 0.01. Similar analysis of the less numerous eosinophilic group yields a "Chi-square" probability of 0.06. Since both the chromophobic and eosinophilic adenomata are seen to respond similarly, they have been combined to give the largest number of cases for statistical analysis. The results of the "Chi-square" test for the entire group of 59 cases of chromophobic and eosinophilic adenomata yield a probability of less than 0.01. The analysis indicates that the observed variation of results with tumor dosage is not due to chance, but reflects a true difference of response with increasing dosage.

planned therapy or for slight to marked recurrence of complaints. The results of this additional therapy were widely variable, and often disappointing. Because of this experience, we decided to analyze statistically the effectiveness of these additional courses of radiation. No noteworthy difference in response was noted between the chromophobic and acidophilic adenomata, and they are therefore considered together in Tables IV and V.

TABLE IV: EFFECTIVENESS OF ADDITIONAL DOSAGE IN MULTIPLE-COURSE THERAPY IN CHROMOPHOBIC AND EOSINOPHILIC ADENOMATA*

Total Preceding Tumor Dose	Tumor Dose of Additonal Course of Therapy		
	0–999 r	1,000–1,999 r	2,000–2,999 r
0–999 r	S†—1 U—6	S—0 U—3	....
1,000–1,999 r	S—0 U—9	S—5 U—5	S—1 U—0
2,000–2,999 r	S—0 U—4	S—0 U—8	S—3 U—0
Over 3,000 r	S—1 U—3	S—2 U—8	S—0 U—3

* Table includes 62 retreatment courses.
† *S.* Satisfactory improvement. *U.* Unsatisfactory result.

In Table IV the results of each additional course of radiation are evaluated in relation to the total dose the patient had received previously. The effectiveness of the previous radiation is not considered in this table, but will be discussed below. In only 21 per cent (13 of the 62 instances) where additional therapy was given was there a satisfactory response. This degree of success compares unfavorably with the 46 per cent improvement following the first course of treatment. It can also be seen that retreatment courses giving up to 1,000 r are particularly ineffective. Of 24 patients receiving this dose only 2 showed satisfactory improvement. Somewhat better results are obtained by additional series when doses of 1,000 r to 3,000 r are given to patients who have had less than 3,000 r to the tumor previously. Nine of the 25 cases previously receiving less than 3,000 r responded satisfactorily to doses between 1,000 r and 3,000 r. Of the 17 cases which received a total tumor dose over 3,000 r previously, only 3 benefited by additional series. In each of these 3 instances the additional therapy was given at least a year after the last treatment, because of recurrence.

TABLE V: EFFECTIVENESS OF ADDITIONAL DOSAGE GIVEN WITHIN NINE MONTHS IN MULTIPLE-COURSE THERAPY IN CHROMOPHOBIC AND EOSINOPHILIC ADENOMATA*

Total Tumor Dose Delivered in Preceding 9 Months	Tumor Dose of Given Course of Therapy		
	0–999 r	1,000–1,999 r	2,000–2,999 r
0–999 r	S†—1 U—9	S—0 U—1	....
1,000–1,999 r	S—1 U—5	S—2 U—6	S—1 U—0
2,000–2,999 r	S—0 U—1	S—0 U—1	S—1 U—1
3,000–3,999 r	....	S—0 U—1	S—0 U—1

* Table includes 32 instances of early retreatments.
† *S.* Satisfactory improvement. *U.* Unsatisfactory result.

In Table IV no consideration is given to the interval between the previous irradiation and the additional course. There were many instances in which several years had elapsed before the subsequent course of radiotherapy was given, and the effectiveness of the previous radiation may well have been completely dissipated. It was felt desirable, therefore, to note the effectiveness of retreatments given after comparatively short intervals. Table V shows the results of additional radiation given within nine months after the conclusion of the preceding series. The findings are similar to those observed in Table IV. Satisfactory results were obtained in 6 out of 32 instances (19 per cent) of early retreatment. Doses up to 1,000 r were markedly ineffective, causing improvement in only 2 out of 17 cases. Where additional doses of 1,000 r to 2,999 r were administered, beneficial effects were obtained in 4 out of 15 instances.

The results of additional radiotherapy in those cases showing no benefit from the first course of radiation were also analyzed. Of 21 such patients, satisfactory results were obtained in only 4 (19 per cent) by additional series. In 2 of these 4 the additional dosage was between 1,000 r and 1,999 r.

TABLE VI: CORRELATION OF CLINICAL STAGE OF DISEASE AND EFFECTIVENESS OF RADIATION THERAPY IN CHROMOPHOBIC AND EOSINOPHILIC ADENOMATA (59 CASES)

Clinical Stage of Disease at Time of Admission	Total Tumor Dose				
	0–999 r	1,000–1,999 r	2,000–2,999 r	3,000–3,999 r	over 4,000 r
Mild	....	*S**—1 *U*—0	....	*S*—1 *U*—0	....
Moderate	*S*—1 *U*—3	*S*—6 *U*—7	*S*—12 *U*—5	*S*—5 *U*—3	*S*—7 *U*—2
Severe	....	*S*—0 *U*—3	....	*S*—1 *U*—0	*S*—1 *U*—1

* *S.* Satisfactory improvement. *U.* Unsatisfactory result.

The remaining 2 cases received more than 2,000 r. None of these 4 patients had received more than 1,000 r to 1,999 r in the first course.

The cases showing satisfactory radiation results were compared with respect to those cases receiving multiple courses and those patients treated with single courses. It was observed that in the group treated by multiple-course therapy the average initial dose was 1,720 r, and the average total dose delivered was 4,070 r. The group showing satisfactory results from a single-course technic had an average of 2,290 r delivered to the tumor. The average period of time following radiotherapy before beneficial effects became apparent was considerably shorter in the single-course group. Thus, with the multiple-course technics a considerably larger average dose was delivered, spread out over a longer time, and a longer average period was required to attain a satisfactory clinical status than with the single-course technic.

A study of the duration of beneficial effects following irradiation showed that of the 19 patients with chromophobic adenomata who had an early satisfactory response, only 3 had a recurrence of symptoms. Two of the recurrences appeared at one and a half years, and the third at three years. Additional therapy resulted in satisfactory remissions. The period of follow-up for the 19 cases varied between six months and twelve years. The average was 3.8 years, with a standard deviation of 2.0 years. Among the 8 patients with eosinophilic adenomata who had early beneficial effects, there was one recurrence, at one and a half years. Retreatment resulted in a satisfactory remission. The follow-up period for this group varied between six months and fourteen years, the average being 4.5 years and the standard deviation 4.5 years. Of the 4 basophilic adenomata with an early satisfactory response, one recurred after six months. Retreatment resulted in a satisfactory remission for two and three-quarter years. A second recurrence appeared and again responded satisfactorily to radiation therapy. At present the patient has shown no exacerbation of symptoms for the past four years.

Thus, among the 31 cases of the three types of adenoma with satisfactory radiation results, there have been 5 recurrences (16 per cent) between six months and three years. All 5 patients have done well with additional therapy.

Table VI shows the correlation of radiation benefit and total tumor dose in the chromophobic and acidophilic cases classified as mild, moderately severe, and severe at the time of first observation. It can be seen that in only 2 patients was the disease classified as mild. Both these patients responded well to radiotherapy. Six of the 59 cases were considered severe. Of these, only 2 responded moderately well to a total tumor dose above 3,000 r. The remaining 4 patients showed no satisfactory response. The great majority of the cases, 51 of the 59, were regarded as moderately severe. In this group there is again a suggestion that there may be a relationship between percentage of satisfactory results and total tumor dose. However, there appears to be little difference in results for total doses above 2,000 r.[5] The large tumor doses were frequently given in multiple courses spread over intervals of varying length.

[5] "Chi-square" test yields a P of 0.21, which is not considered significant statistically.

COMMENT

Reports of other authors (4, 10, 11, 12, 13) and our own findings appear to indicate that, despite the frequent definite clinical success of roentgen therapy in patients with pituitary adenomata, the adenoma was in no case completely destroyed. As a result, the aim of radiotherapy in these cases becomes somewhat different from that in malignant disease. In the latter, the goal is complete disappearance of the tumor with maximum preservation of normal structures. In the treatment of the adenomata, however, the tumor (practically) never disappears. The assessment of radiation effect is made purely on the basis of clinical improvement. Since this is the criterion of radiation success, the optimal procedure and dose would appear to be that which causes the most rapid clinical recovery with the lowest recurrence and brain damage rate in the largest number of cases.

The present study and those of other investigators have indicated that cystic adenomata occurred in up to 20 per cent of the cases and have been rather uniformly radioresistant. The much larger number of non-cystic lesions have shown a marked variation in radiosensitivity. Unfortunately, there is no adequate method of consistently foretelling whether a pituitary tumor is cystic or how sensitive to radiation it will prove. It therefore becomes necessary to deliver the maximum optimal dose in every case.

Survey of the literature with special reference to the correlation of the tumor dose and improvement was not entirely satisfactory, since the radiation has not been expressed too often in terms of tumor dose, and the exact evaluation of improvement may be subject to considerable variation of interpretation. Nevertheless, it would appear that the general recent trend of various investigators is toward increasing the tumor dose (7, 8, 9). Among the best results obtained are those of Kerr (7), who reported satisfactory improvement in 70 per cent of 50 patients with a single-series technic administering about 3,000 r tumor dose in one month. Evans and Picciotto (8) have also recently suggested that about 3,000 r tumor dose in one month would appear to give optimal results in the largest number of cases. Our own findings yield conclusions in close accordance with the opinions of these authors. Analysis of our material has shown that a tumor dose of up to 1,000 r delivered in a single series fails so often that it is obviously underdosage. Considerably greater success is obtained with doses between 1,000 r and 2,000 r, and still further improvement is noted following tumor doses of 2,000 r to 3,000 r. There was insufficient material for any statement concerning doses above 3,000 r delivered in one course. However, during the preparation of this paper, Kerr's article on the same subject appeared. His excellent results with doses in the range of 3,000 r would appear to supply the necessary additional data for the determination of the optimal dose. His improvement rate of 70 per cent would seem to be near the maximum that could be expected from radiotherapy, since up to 20 per cent of the lesions are cystic and 10 per cent of the adenomata might easily be of the radioresistant variety.

The significant difference in response to radiation between the cases which had received no prior radiotherapy and those which were being retreated after an unsatisfactory result from a first course (see Table II) would appear to be of some importance. It would seem that the initial course of therapy would, if at all adequate, make the division between the radiosensitive tumors and the cystic and/or radioresistant lesions. As a result, improvement from additional roentgen therapy could be expected only in a minimal number of cases if an adequate first course was unsuccessful.

On the other hand, additional improvement has been observed in a number of cases which responded moderately to tumor doses up to 2,500 r, when a second course was administered after a brief interval. This would appear to indicate that greater dosage could have been given in-

itially to obtain the earliest optimal effect. Further, although the number of cases was small, in no case did the early second series result in improvement if the initial tumor dose was above 3,000 r.

In the cases that were treated by multiple-series technics the initial dose was frequently found to have been too small. Improvement, when it occurred, appeared after a considerably greater interval than in the cases given larger initial tumor doses. Further, when "improved" cases were divided into single-course and multiple-course groups, it was found that the average total dose (and therefore the possibility of brain damage) in the latter was considerably greater than in the former. These compared groups do not include the cases showing recurrence and requiring additional therapy. The evidence would appear to agree with the theoretical consideration that, since the additional series were given at varying intervals, the tissue recovery factor would necessitate a larger total dose to obtain the same effect as for the single short-course technic.

Our data suggest that the optimal tumor dose for the average moderately severe case lies between 3,000 r and 4,000 r delivered in about thirty to forty-five days. With such dosage the number of cases showing any appreciable further effect from early additional radiotherapy would appear to be too small to warrant retreatment. If this first series fails, surgery would seem indicated. Frequent study of the visual fields is of importance. Further contraction of the fields after two months following the conclusion of therapy would appear to be adequate cause for surgical intervention. An occasional temporary decrease in the visual fields early in the course of therapy has been noted in this series. Shortly thereafter the fields re-expanded. If this field decrease is not too great, continuation of radiation is thus not contraindicated.

Although the evidence is much less conclusive, we also have the impression that the more advanced cases may benefit from greater dosage. Where actual destruction of the bones of the cranial base adjacent to the sella is observed, doses up to 6,000 r in thirty-five to forty-five days may be warranted even though the possibility of brain injury exists. Henderson's (4) study of Cushing's series indicates that these cases give the poorest results with surgery, and might even be considered inoperable.

In 5 of our cases (16 per cent) there was recurrence of symptoms after an interval of up to several years. Retreatment of these recurrences again proved beneficial. Thus, it would appear that if an adequate initial series was followed by satisfactory improvement and then recurrence, a second course might be given with expected improvement in a considerable number of cases. The optimal tumor dose for the retreatment courses cannot be stated with any degree of certainty. The possibility of brain damage from a second large dose must be considered. It should be stressed, however, that this second course is reserved for that small number of cases showing satisfactory improvement and then recurrence, and not for cases failing to respond to the first course.

The low rate of recurrence in our series was in general accord with the very low recurrence rate reported by Kerr. In addition, Henderson's report on Cushing's series showed that the five-year postoperative rate without recurrence for the transfrontal procedure was 57.5 per cent, and with postoperative radiotherapy 87.1 per cent. The effectiveness of radiation becomes all the more apparent when it is realized that in many of these cases comparatively small doses were administered.

SUMMARY

1. Microscopic study in each of 16 cases of pituitary adenomata following radiation therapy failed to show destruction of the tumor. In most of these cases there was no evidence of any radiation effect.

2. The over-all results of radiation therapy in 64 treated cases are presented. Distinct improvement was obtained in 58 per cent of 38 cases of chromophobic adenomata, 43 per cent of 21 cases of

eosinophilic adenomata, and 4 out of 5 cases of basophilic adenomata.

3. The beneficial effects were correlated with tumor dose. It was shown that increasing dosage resulted in a greater incidence of improvement.

4. The results with multiple-course therapy were compared with single-course therapy. On the average, the latter resulted in earlier benefit with lower total dosage.

5. The summation of evidence indicates rather conclusively that while pituitary adenoma is practically never destroyed by roentgen rays, its size is definitely decreased and its growth potentiality considerably diminished in a large percentage of cases. For this reason, it becomes highly desirable that the optimal tumor dose be delivered in as short a time as possible to obtain the maximum early benefit in the greatest number of cases. The present estimate of optimal therapy is the administration of a 3,000 r to 4,000 r tumor dose in thirty to forty-five days for a case of average severity. If no early satisfactory improvement occurs, surgical intervention would appear indicated. No satisfactory result could usually be expected from an early additional series following the above dosage. However, if the first series resulted in considerable improvement and was then followed by recurrence, at least some success might be expected from a second series. The optimum dosage of the latter remains to be determined. Further study of the value of radiation and its optimum dosage for advanced cases with bone destruction also appears warranted.

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SUMARIO

La Roentgenoterapia en el Adenoma Hipofisario: Correlación de la Dosis Tumor con la Respuesta en 64 Casos

El estudio microscópico de cada uno de 16 casos de adenoma de la hipófisis después de la radioterapia no reveló destrucción del tumor. En la mayor parte de esos casos no había el menor signo de efecto alguno de la radiación.

Preséntanse aquí los resultados globales de la radioterapia en 64 casos: neta mejoría en 58 por ciento de 38 casos de adenoma cromófobo, 43 por ciento de 21 casos de adenoma eosinófilo y en 4 de 5 casos de adenoma basiófilo.

Al correlacionar el efecto beneficioso con la dosis tumor, observóse que el aumento en la dosis daba por resultado mayor incidencia de mejorías.

Comparados los resultados obtenidos con varias series de terapéutica con los obteni-

dos con una sola serie, en conjunto, la última logró beneficio más pronto con dosis total menor.

La compilación de datos indica en forma bastante terminante que, si bien el adenoma hipofisario no es casi nunca destruído por los rayos X, en un elevado porcentaje de casos disminuye claramente su tamaño y se atenúa considerablemente su potencialidad de desarrollo. Por esta razón, conviene sobremanera facilitar la dosis tumor óptima en el más breve plazo posible a fin de obtener el efecto temprano máximo en el mayor número de casos. Según los cálculos actuales, la terapéutica óptima consiste en la administración de dosis tumor de 3,000 a 4,000 r en treinta a cuarenta y cinco días, en un caso de gravedad mediana. Sino hay mejoría satisfactoria temprana, parece indicada la intervención cruenta, pues por lo general no cabría esperar resultado satisfactorio con otra serie pronta después de la dosis mencionada. Sin embargo, si la primera serie logró mucha mejoría y fué después seguida de recurrencia, cabría esperar a lo menos algún beneficio de la segunda serie. Está aun por determinar la dosis óptima de la última. También parece indicado el estudio ulterior del valor de la radiación y de la dosis óptima para los casos avanzados con destrucción ósea.

DISCUSSION

Henry L. Jaffe, M.D. (Los Angeles, Calif.): This paper by Drs. Bachman and Harris adds further proof that pituitary adenomata are frequently responsive to roentgen therapy. The figures presented emphasize the importance of delivering an adequate tumor dose in the range of 3,000 r in one series of treatments. When we reviewed our own results, we found that our failures were frequently due to inadequate tumor doses and to the presence of cystic lesions. For the past five years, we have employed a technic which includes at least three portals and which delivers approximately 3,000 r to the tumor in one uninterrupted course of daily treatments.

The authors are to be congratulated on their accurate analysis of their various technics. This type of clinical research gives us a basis for improving our end-results.

Some neurosurgeons still believe the old teaching that chromophobe tumors of the pituitary gland are radioresistant and therefore should be treated primarily by surgery. Drs. Bachman and Harris have shown that some of the chromophobe tumors in their series are not only radiosensitive but are more radioresponsive than the chromophile tumors. It becomes our duty to pass this information along to the neurosurgeon and to the general practitioner. Dr. Dabney Kerr has recently published his results of the primary roentgen treatment of pituitary adenomata. His overall figures show up to 70 per cent satisfactory response.

We feel that the radiotherapist might avoid a pitfall by the careful daily examination of the patient during the course of treatment. If the visual fields show progressive narrowing, then radiation therapy should be discontinued and the patient referred for surgery.

Although most of us carefully check the placement of our patients before each treatment, there are still some radiologists who turn their patients over to a technician after prescribing the treatment. This is no more sound than letting a surgical nurse remove a pituitary tumor for the neurosurgeon.

If a patient fails to show a satisfactory response to an adequate total tumor dose after a period of six weeks has elapsed, it is best to turn him over to the neurosurgeon. Retreating these patients may cause unnecessary delay and may result in radionecrosis of surrounding tissues. Although the authors report some success in retreating the radioresponsive cases when they show a recurrence, we feel that this procedure may also lead to cerebral complications. The blood vessels near the previously irradiated field may not be adequate to take an additional amount of radiation, and there is some danger of radiation necrosis. This is especially true when the recurrence occurs one to two years after the primary intensive course of treatment. The neurosurgeon never forgets when such complications arise. It usually results in a loss of his enthusiasm for this type of treatment for other patients who might benefit from radiation therapy. We have observed no harmful effects from properly executed roentgen treatment of pituitary adenomata. When the neurosurgeon insists on operating as a primary form of treatment, we advise postoperative roentgen therapy.

B. V. A. Low-Beer, M.D. (San Francisco, Calif.): I so thoroughly agree with the analysis of the problem of roentgen therapy of pituitary adenomas presented by Drs. Bachman and Harris that it almost does away with my discussion en-

tirely. You all know how sound Dr. Harris's approach is to any problem of radiation therapy, and I am again glad to have had this opportunity to listen to his analysis. We must admit that the problem of dosage and total dose in the radiation therapy of pituitary adenomas has received less thorough consideration than has been given to tumors of other types and in other locations.

Attention has been given to reducing the mass of the tumor rather than to attacking its functional influence. This approach has been expressed in multiple-course treatments and frequently has produced palliation only. In a study of radiation therapy of intracranial tumors published in 1935, I analyzed my observations of 12 adenomas of the pituitary. I felt rather radical in giving tumor doses between 2,500 and 3,500 r tissue dose. Only in the last eight years have I been persuaded to give as high as 4,000 r tissue dose. I believe, however, that even this tumor dose is not adequate in many pi uitary adenomas.

I believe that greater emphasis on laboratory findings concerning pituitary function and the relation of these findings to radiation dose will lead to more accurate determination of adequate radiation therapy in such cases.

A New Technic for the Radium Treatment of Carcinoma of the Bladder[1]

MILTON FRIEDMAN, M.D.,[2] and LLOYD G. LEWIS, M.D.[3]

TREATMENT OF cancer of the urinary bladder entails not only eradication of the primary tumor by methods tolerable to the patient, but also prevention of recurrent and new tumor growths. The high incidence of new growths following local resection, fulguration, or irradiation, and the necessity of relentlessly guarding against recurrence by periodic examination, are evidence of the inadequacy of the present methods of treatment. To meet these problems, a new radium technic was devised and first used at Walter Reed General Hospital on July 18, 1945. Favorable experience with the first 13 cases warrants this preliminary report.

The Walter Reed technic entails isoirradiation of the lower two-thirds of the bladder wall with fractionated exposures of penetrative gamma rays from a focal source of radium, radon, or radioactive cobalt fixed at the center of the bladder cavity. With this procedure certain disadvantages of other methods of irradiation are circumvented. Interstitial irradiation with radium needles or radon implants often results in focal radionecrotic ulceration attended by intractable pain, fistula, and fibrosis. Surface application of radium through a cystoscope is inaccurate and ineffective. External irradiation with x-rays, especially supervoltage irradiation, is occasionally effective, but may injure the bladder and adjacent bowel, and is frequently followed by a fibrosed contracted bladder of small capacity.

THE WALTER REED TECHNIC

Preoperative Diagnosis and Delineation of the Tumor: It is first necessary to ascertain as accurately as possible the geometric size, location, and type of the tumor to be treated. This is done by cystoscopy, biopsy, and pyelography and cystography with an opaque medium or air. Radiographic examination should include anteroposterior and postero-anterior as well as lateral and oblique views of the bladder, for occasionally these may yield more information as to infiltration and extravesical extension than direct observation and palpation of the opened organ.

Cystotomy: At the time of the first radium insertion, the bladder is opened by suprapubic cystotomy and the tumor carefully inspected and classified. A papillary tumor with a narrow pedicle is totally resected with scissors, and the mucosa is sutured (Fig. 1). A bulky papillary tumor with a pedunculated or broad base is removed by electrosurgery, care being taken to cut down to the base only and not into the bladder wall, leaving a flat, slightly elevated sessile base of partly coagulated tissue about 3 or 4 mm. thick. If coagulation is carried down to the level of or into the bladder wall, secondary infection plus subsequent irradiation will unduly retard healing and result in an indolent ulcer requiring several months to heal, attended by painful cystitis. If the tumor is flat or sessile (Case 8) coagulation is unnecessary. An unduly bulky tumor, or markedly enlarged prostate, which may prevent ideal apposition of the radium bag to the tumor, should be pared down or removed by electrosurgery.

The advantages of a cystotomy are numerous. For accurate irradiation by this precision technic, clear observation of the

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[1] Presented at the Thirty-fourth Annual Meeting of the Radiological Society of North America, San Francisco, Calif., Dec. 5–10, 1948.

[2] Assistant Professor of Radiology, New York University, and Consultant in Radiation Therapy to Walter Reed General Hospital, Washington, D. C.

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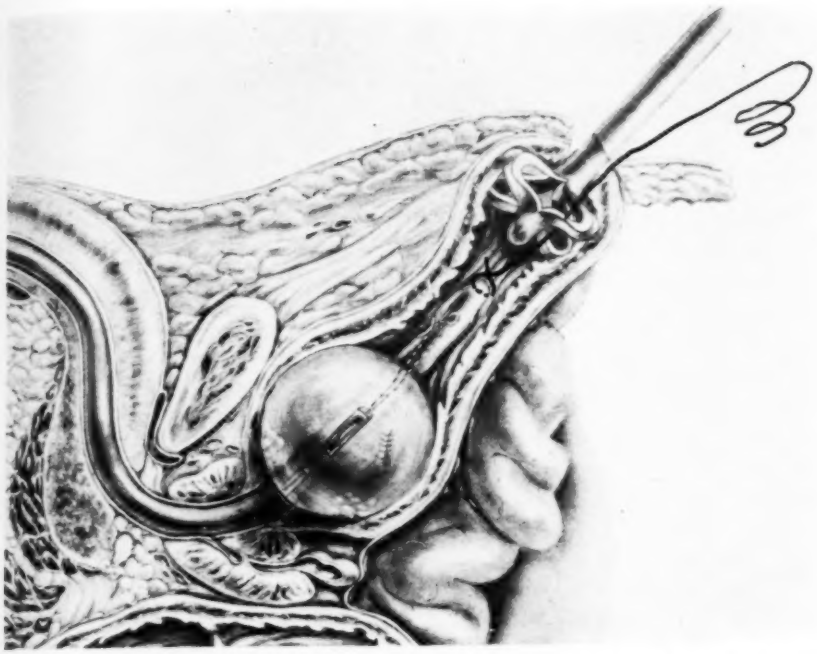

Fig. 1. Radium applicator in position in Case 3. A two-channel Foley catheter, F 22 gauge, and 30 c.c. rated capacity, has been distended with 40 c.c. of 5 per cent sodium iodide solution so that the radium-tissue distance is 2.2 cm., see Figure 3 (2). The radium capsule occupies the central channel. To the tip of the catheter is sewed a heavy silk thread, 2 feet in length, which extends through the cystotomy stoma and rests on the abdominal wall. It assists in reintroduction of the catheter at the second radium treatment. Two tumors and the base of a resected tumor can be seen in contact with the surface of the bag.

In a majority of cases, the distended bag is larger in relation to the size of the bladder and irradiates the lower three-fifths of the organ, including a large area above the interureteric ridge of the trigone.

tumor is necessary. Cystotomy assists in the selection and fitting of a bag of the correct size and shape and confirmation of its proper apposition to the tumor. It is occasionally impossible to insert the radium-carrying catheter because of a hypertrophied prostate or narrowed urethra. This difficulty is more frequently found at the second insertion, as a result of pressure irritation from the first treatment. This may be overcome at cystotomy by the retrograde insertion into the urethra of a string, which is then tied to the radium-containing catheter and pulled through the urethra back into the bladder (Fig. 1). The cystotomy opening also provides easy drainage of urine. Otherwise urine will accumulate in the bladder, pushing the bladder wall away from the surface of the balloon, thereby materially reducing the dose of radiation to the tumor. If an operation is contraindicated, the three-channel catheter must be resorted to. This is less satisfactory, as the technic becomes relatively inflexible and routine.

The Radium Applicator: There should be available a variety of Foley catheters with diameters ranging from 18 F to 24 F. The designated capacities of the radium bags are 30 c.c. and 100 c.c. The Foley catheter (two channels) is used when cystotomy is performed (Fig. 1). The major channel will contain the radium while the small channel is used to inflate the bag. The urine is drained suprapubically. A Foley-Alcock catheter (three channels) is used rarely; only when the bladder is not opened and the entire procedure is carried out transurethrally (Fig. 2). The third channel drains urine from the bladder.

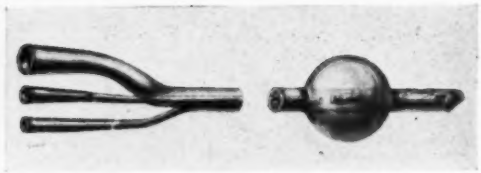

Fig. 2. Radium in position in a three-channel Foley-Alcock catheter, for use when cystotomy is not employed. The large central channel contains the radium; a second smaller channel drains the bladder; and the third channel leads to the cavity of the bag. If the lumen of the central channel is large or the diameter of the radium capsule is small, so that friction does not hold it fixed in position, a cotton plug or piece of applicator stick is inserted alongside the capsule to hold it in position. The thread from the radium capsule is tied around the nipple of the catheter for additional security.

Before selecting the catheters, the balloons should be distended with water, and only those should be chosen which inflate symmetrically. The radium capsule must be equidistant from all surfaces of the bag, and consequently from the bladder mucosa.

The radium applicator is prepared in the operating room on a sterile table. There should be available 200 c.c. of 5 per cent solution of sterile sodium iodide, 10 c.c. methylene blue solution, 200 c.c. sterile water, suitable calipers to measure the diameter of the distended bag, and a 50 c.c. glass syringe. Methylene blue is used to color the sodium iodide solution so that leakage may be apparent in case the balloon breaks while in the bladder. The sterile water is used for preliminary test dilatation of the Foley bag.

The radium capsule has been specially constructed. The ideal radium source would be a point source, but 25 mg. of radium cannot be compressed to this size; the smallest practical unit is a capsule whose active length is 1 cm., with a wall thickness of 0.5 mm. platinum, external length 15 mm., external diameter 2.3 mm., with a bulldog eyelet at one end for threading. When the radium is centrally placed in the inflated bag, the radiation at all points on the surface of the bag has a fairly homogeneous isodose distribution.

After the bladder has been opened and the tumor inspected, the proper Foley catheter is chosen. A tumor in or near the

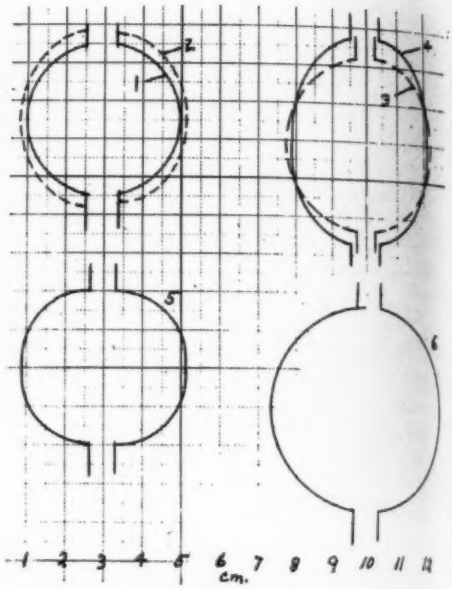

Fig. 3. Contours of distended bags. 1. 30-c.c. bag distended with 30 c.c. solution. Diameters 4.0 × 4.0 cm. 2. 30-c.c. bag distended with 40 c.c. solution. Diameters 4.2 × 4.2 cm. 3. 30-c.c. bag distended with 50 c.c. solution. Diameters 4.3 × 4.5 cm. (oblate spheroid). 4. 30-c.c. bag distended with 50 c.c. solution. Diameters 4.2 × 5.3 cm. (prolate spheroid). 5. 30 c.c. bag distended with 40 c.c. solution. Diameters 4.0 × 4.2 cm. 6. 100-c.c. bag distended with 70 c.c. solution. Diameters 5.2 × 5.3 cm.

The oblate spheroid, such as 5, provides the best isodose distribution around its surface for a 1-cm. active length radium source. A prolate spheroid, such as bag 4, is suitable either (*a*) for a radium source whose active length is approximately 1.7 cm. or (*b*) for a 1-cm. active length capsule, when the lesion is situated on the interureteric ridge or above the trigone.

vesical neck or trigone requires a bag of 30 c.c. capacity. Tumors extending above the trigone may require a 100-c.c. bag. The shape of the bag varies with the amount of fluid in it (see Fig. 3). It must be tensely distended in order to attain a spherical shape. The diameter of the distended bag ranges from 4 to 5 cm. The catheter most commonly used is one of 30 c.c. capacity and 22 F gauge, which, when over-distended with 40 to 50 c.c. of solution, reaches a diameter of 4.0 to 4.4 cm. The largest bag used in this series was a 100-c.c. bag which required 80 c.c. solution to distend it to a diameter of 5 cm. (see Case 13).

After the catheter has been selected, the radium capsule is threaded and inserted

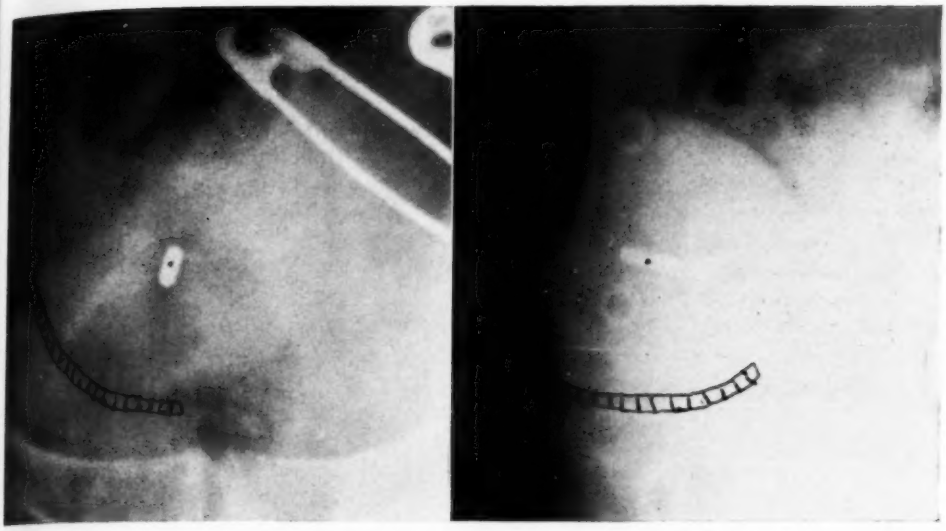

Fig. 4. Anteroposterior and lateral views of radium in a recent patient not included in the series reported here. The shaded area indicates the residual base of a broad, sessile, papillary carcinoma. The active length of the radium source is 1 cm., and filtration is 0.5 mm. Pt. The small dot marks the center of the radium source; from this point, distances are measured. The total diameter of the bag was 4.5 cm. However, inflation of the bag was eccentric, so that radium-tissue distance was calculated, with the aid of these roentgenograms, to be 2.1 cm. Since the radium was closer to and delivered a larger dose to the tumor than to the normal bladder mucosa, an ideal situation was obtained. If these relationships are reversed, the catheter is replaced immediately. The string, attached to the tip of the removed catheter, is tied to the new catheter and assists in inserting it into the bladder.

into the major drainage channel through one of the openings in the tip, so as to occupy the middle of the central axis of the balloon. Because of the difficulty in locating the mid position when the bag is collapsed, it should be partly distended with about 20 c.c. saline solution and the radium correctly adjusted. In large-gauge catheters, a plug of cotton or a piece of a wooden applicator stick can be packed between the capsule and the wall of the lumen to hold the radium fixed in position. The threads are tied around the tip of the catheter as illustrated in Figure 1.

The bag is then completely deflated and is ready for insertion. The inflating solution of 5 per cent sodium iodide is colored with a small amount of methylene blue. As suggested by Harris,[4] seepage of the dye will indicate accidental collapse of the bag or leakage during the radium treatment.

Radium Insertion: The deflated radium-containing Foley catheter is introduced through the urethra into the bladder, while maintaining a sterile field. The bag is pulled up out of the suprapubic wound and inflated with a predetermined measured amount of dilute sodium iodide and methylene blue solution. At this time, the diameter of the bag is measured again to assure accuracy. A heavy silk thread, two feet long, is sutured to the tip of the catheter. The fluid is then withdrawn into the syringe; the bag is pulled down into the bladder, and the fluid reinjected into the bag. The position of the bag in relation to the tumor is now carefully inspected. The configuration and muscular contraction of the bladder will hold the bag fixed in the lower portion of the bladder. If all parts of the tumor are not in direct contact with the surface of the bag, the latter should be inflated further or replaced with one of larger capacity. The syringe is removed and the mouth of the bag-inflating channel clamped and tied. The wound is now closed and a suprapubic tube is inserted (Fig. 1). The heavy silk thread, tied to the tip of the catheter, extends out through the

[4] Personal communication.

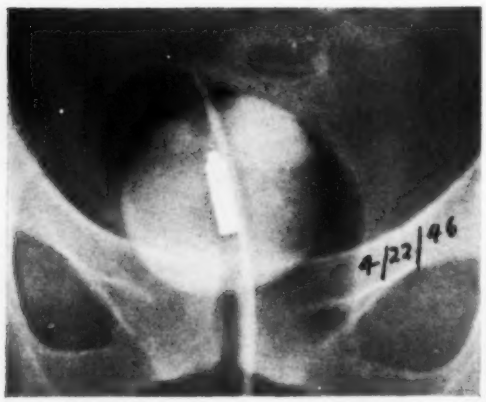

Fig. 5. Case 1. Radium in a three-channel catheter, used without cystotomy. This procedure is not recommended, as the drainage channel frequently becomes obstructed and the urine readily pushes the bladder wall and tumor away from the surface of the balloon. The roentgenogram shows how the introduction of a small amount of air, under slight pressure, will push the bladder wall from the surface of the bag. The radium capsule used in the early cases contained 5 cells of 5 mg. radium each. Primary filtration of each cell was 0.2 mm. Pt; that of the capsule was 0.8 mm. Pt. This bulky capsule with irregular and heavy filtration is undesirable because it does not act like a point source.

suprapubic stoma and is left on the abdominal wall.

When the radium-containing catheter is removed after the first treatment, the string is pulled out through the urethra and severed. During the rest period, six inches of the string protrude from the urethra and six inches through the suprapubic stoma. At the second treatment, the string is tied to the new catheter, which is then pulled into the bladder by means of the string projecting from the suprapubic stoma.

Immediately after operation, radiographs should be taken, anteroposterior and lateral views, to assure that the bag and the radium are in proper position and symmetrically inflated. In the event of asymmetrical dilatation (Fig. 5), the dosage calculation should be corrected or the catheter withdrawn. It is wise to repeat the radiographic examination after two days. Each day the portion of the catheter protruding through the urethral meatus should be gently tugged to make sure that it rests in the lower portion of the bladder.

When cystotomy is not performed and a three-way Foley-Alcock catheter is used, the only additional precaution is to check the drainage channel daily by injecting and immediately withdrawing some saline. Otherwise, urine may push the bladder wall and the tumor away from the balloon (Figs. 5 and 6).

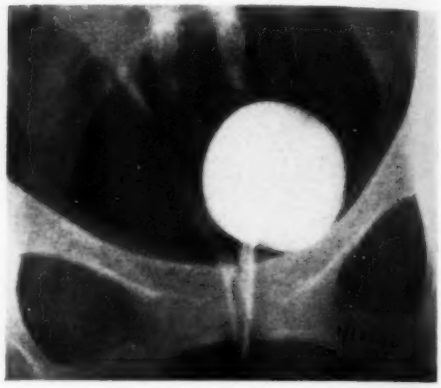

Fig. 6. Case 2. Three-channel catheter used without cystotomy in a female patient. The drainage channel became plugged and an additional catheter was inserted. Note how readily injected air (or retained urine) will push the bladder wall away from the bag. This is one of the reasons why cystotomy is desirable.

In two of our cases, the bag in the bladder produced very painful spasm. A preceding spasm tends to be aggravated by the presence of the bag. Frequent morphine injections may occasionally become necessary during the radium exposure. In one instance of multiple papillary carcinomas (Case 13) which were coagulated deep into the wall of the bladder, there was violently painful spasm during the first radium treatment, which lasted five days. For the second treatment, a 100-millicurie capsule of radon was employed, and the entire second dose given in a single day.

DOSAGE AND EXPOSURE TIME

The dose is expressed as the number of gamma roentgens delivered to that portion of the bladder wall in contact with the surface of the distended bag. This dose is approximately homogeneous on all surfaces of the bag. In our experience, the most common "radium-tissue distance" (which is the radius of the inflated bag) was 2.2

TABLE I: MILLIGRAM HOURS NECESSARY TO PRODUCE 1,000 r_γ AT VARIOUS RADIUM-TISSUE DISTANCES*
(Active length of radium source 1 cm.)

Radium-Tissue Distance (cm.)	Milligram Hours Necessary for a Filter of	
	0.5 mm. Pt	1.0 mm. Pt
2.0	484	535
2.1	530	590
2.2	585	650
2.3	635	712
2.4	690	780
2.5	753	835
2.6	812	910
2.7	875	983
3.0	1,080	1,200

* Based on the Paterson and Parker gamma roentgen dosage system.

cm. Under these conditions, a 25-mg. radium capsule will give in twenty-four hours an exposure of 600 mg. hr., and a tissue dose of approximately 1,000 r_γ to the surface of the bladder. Table 1 contains dosage data useful in the treatment of bladder cancer.

The average range of the total dose is from 5,500 to 9,000 r_γ. The dose is preferably administered in two sessions, with a total period of ten to twelve days from the first to the last treatment. The first session, usually lasting four days, should deliver approximately 4,000 r_γ to the surface of the bladder. The radium is removed for three to five days and then reinserted.

Immediately prior to the second insertion, cystoscopic examination is performed and an attempt made to evaluate the amount of clinical shrinkage. At the same time, whenever possible, a biopsy of the tumor is taken for the purpose of evaluating the histologic destruction produced by the first 4,000 r_γ.

Interruption of treatment permits bladder and urethra to rest and to recover from the effects of pressure irritation. This probably minimizes, to some extent, the intensity of the later reaction of the mucosa. The interruption of the treatment also allows time for additional shrinkage of the tumor, which brings its outer portion closer to the radium so that the tissue dose to the outlying tumor cells increases proportionately during the second treatment.

The dose to be administered in the second session will depend upon the amount of clinical shrinkage and the information yielded by the biopsy. A total dose of 5,500 r_γ is the average minimal lethal dose for bladder carcinoma, and will produce a mild cystitis with a few tolerable symptoms. Doses of 8,000 r_γ or more will produce a moderate to severe painful cystitis. An occasional radioresistant tumor will require more than 8,000 r_γ which will produce severe cystitis. In some instances, however, the bladder will be able to tolerate large doses without undue complications.

The total interval from the first to the last treatment varied from five to twenty-three days in this series. In 5 patients, the treatment was given in one session lasting five to seven days. In one instance, it lasted ten days. A single radium session was used for smaller lesions. While it seems more efficient and surer to employ two sessions, we have not yet decided whether the results are significantly jeopardized by limiting treatment to a single session.

It would appear that a large area of normal bladder mucosa is unnecessarily exposed to irradiation. This frequently is advantageous, in that remotely situated papillomata are thereby successfully irradiated and the appearance of new papillomata is prevented. Furthermore, this broad-area irradiation can effectively destroy seeded carcinoma implants or undetectable satellite submucosal infiltrations. Another advantage of the technic is that the muscle wall and lymphatic channels, which may be seeded with cancer cells, are effectively irradiated.

In the few instances of moderate to severe cystitis, the symptoms were not due to over-irradiation of the normal mucosa, but to a persistent infected ulcer at the site of the tumor. Such persistent post-irradiation ulcers tend to occur when preliminary electrocoagulation has extended deep into the bladder wall and subsequent irradiation has caused the ulcer to become indolent.

The doses recommended above were ar-

rived at by trial and error. In our series, as can be seen from Table II, the dose ranged from 5,130 r_γ in seven days to 11,000 r_γ in fifteen days.

As stated above, we consider it preferable to deliver the radium dose in two sessions, as this permits modification of the total dose to suit the behavior of the lesion. Occasionally it may be desirable to deliver the entire dose in one session. It must be recalled that a smaller total dose over a shorter period of time will produce the same reaction as a larger dose over a longer period of time. For example, in Case 10, the total dose was 5,260 r_γ in five days and the reactions were mild. Cases 6 and 8 received larger doses but over a longer period of time: 7,690 r_γ in ten days and 7,380 r_γ in eleven days, respectively. Reactions were mild in these cases also. Cases 12 and 4 received larger doses, approximately 7,450 r_γ, in six and seven days, with more severe reactions because the doses were given in a shorter time. These three groups are cited because they represent the doses commonly employed and because the relation of "dose" and "time" to reaction remained consistent (Fig. 7). Case 1 and Case 13 should have had mild reactions because the irradiation was extended over a long period of time. Nevertheless, their reactions were severe. In both patients, primary electrocoagulation had extended deeply into the bladder wall.

The data on "over-all time" *vs.* "dose" were plotted (Fig. 7) in relation to the epithelitis reaction of the bladder mucosa, in order to assist in arriving at a dose for a particular case. In this graph symbols are as follows:

M. Mild reaction
O. Moderate reaction
S. Severe reaction

The reaction represents the epithelitis of the normal bladder mucosa as well as the reaction in the tumor. An average line arbitrarily drawn through the points representing a mild reaction, signifies the lethal doses for different over-all time periods for tumors of average radiosensitivity. It has no statistical value, because as yet there

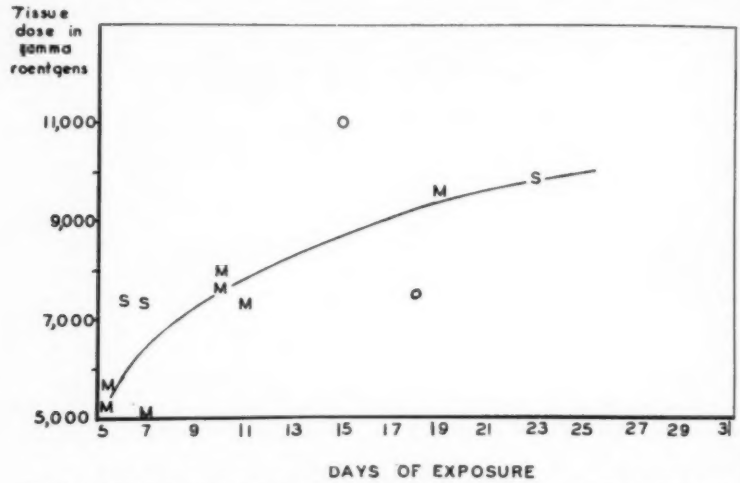

Fig. 7. Study of reactions of bladder mucosa in relation to "over-all time" *vs.* "dose." M. Mild reaction. O. Moderate reaction. S. Severe reaction. For example: at the extreme right, 9,840 r_γ in twenty-three days resulted in a severe reaction; at the extreme left, in two cases, 5,260 r_γ and 5,340 r_γ in five days produced mild reactions.

The curve is arbitrarily drawn through points representing mild reactions. It has no statistical value, but may be useful in deriving the dose in a specific case. For example, in a radioresistant lesion it will be necessary to choose a time-dose value above the line in order to produce a severe reaction.

TABLE II: TREATMENT IN THIRTEEN CASES OF CARCINOMA OF THE BLADDER

Case No.	Date of First Radium	P—Primary R—Recurrent A—Advanced M—Multiple	Description	Radium-Tissue Distance (cm.)	Mg. hr.	Gamma Roentgens (r)	Over-all Treatment Time (days)	No. of Treatments	Reaction	Result (No. of Months Alive)*
1	4/22/46	P-M	Papillary and infiltrating	2.2	5,500	9,840	23	3	Severe	40
2	1/14/46	R-M	Squamous-cell, infiltrating	2.0	6,000	11,000	15	2	Moderate	43
3	7/18/45	P-M	Papillary	2.2	4,488	8,000	10	2	Mild	49
4	5/18/46	P	Papillary	2.2	4,200	7,486	7	1	Severe (accident)	39
5	5/3/46	P(post-op)	Transitional-cell, infiltrating	2.2	5,400	9,625	19	2	Mild	39
6	7/9/46	P	Papillary, sessile	2.4	6,000	7,690	10	1	Mild	37
7	1/9/47	R	Papillary	2.15	3,000	5,260	5	1	Mild	31
8	6/11/47	P	Infiltrating and papillary; sessile	2.2	4,800	7,380	11	2	Mild	26
9	8/12/47	P-A	Infiltrating, transitional-cell (into prostate)	2.0	3,000 plus x-ray	5,340 4,634	5 37	1	Mild	24
10	10/8/47	P	Papillary	2.0	3,335	5,130	7	1	Mild	22
11	12/1/47	P-A	Transitional-cell, infiltrating	2.5	3,600	4,200	6	...	Mild	Died during second radium treatment
12	6/25/48	P	Papillary	2.0	3,600	7,440	6	1	Severe	14
13	10/27/48	P-M-A	Papillary; seven large tumors	2.5	5,800	7,700	18	2	Severe	10

* The figures in this column were audited on Aug. 15, 1949.

are too few points. The two groups of M points, however, offer a somewhat reliable guide. For example, in treating a radioresistant tumor, it will be necessary to select an "over-all time-dose" point located above the line and produce a severe reaction.

EVALUATION OF CLINICAL AND HISTOLOGIC SHRINKAGE BEFORE SECOND RADIUM INSERTION

Evaluation of clinical and histologic shrinkage by cystoscopy and transurethral biopsy immediately before the second radium insertion is an important feature of the Walter Reed technic. Ideally, the bladder should be opened for the second radium treatment. This affords opportunity for careful study of the effect of the first treatment and a proper biopsy, permitting the radiotherapist to exercise his best judgment as to the dose to be given in the second treatment. Most patients, however, cannot stand a second cystotomy because of age and weakness. Furthermore, wound healing is retarded. Therefore, only in the presence of extensive or infiltrating lesions, or when there is doubt concerning the accuracy and precision of the first radium treatment, should the bladder be reopened for the second treatment.

In most cases, clinical shrinkage will be evaluated cystoscopically. To arrive at an accurate evaluation, experience is required. The second biopsy specimen, taken cystoscopically, is helpful in determining the radiation effect in only a third of the cases. Frequently it is impossible to obtain sufficient tissue with the cystoscopic punch to study irradiation effects, and many specimens consist only of necrotic tissue.

Until sufficient experience has been attained, one must rely on the type of tumor and histologic grade to determine the total dose to be delivered.

SUPPLEMENTARY IRRADIATION

When the tumor is thicker than 2 cm., and surgery is contraindicated, it may be advisable to supplement radium with external roentgen therapy to provide a lethal

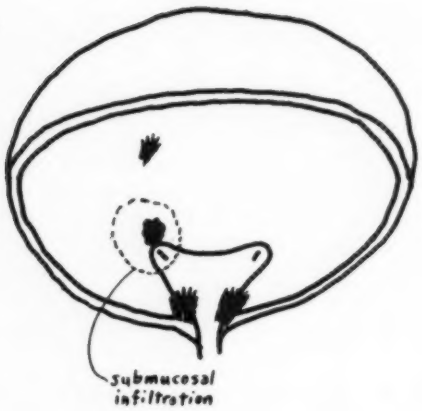

Fig. 8. Case 1. Papillary carcinoma, grade 2, with infiltration of adjacent submucosa, situated above right ureteral orifice. Three additional papillomata.

dose to the outlying parts of the tumor. In females with carcinoma at the trigone, supplementary irradiation can be given with radium corks or plaques placed in the vagina.

CASE REPORTS

CASE 1: A. F., female, aged 52. Infiltrating and papillary carcinoma, grade 2, and three separate papillomata of the bladder. Duration one year.

Cystoscopic examination showed a small nodular projection, 1.0 cm. in diameter, located 1.5 cm. above the right ureteral orifice, surrounded by edema from submucosal infiltration (Fig. 8). In addition, there were three small papillomata. A biopsy was taken of the primary tumor and the base was coagulated. Radium was inserted on April 22, 1946. Since the patient refused cystotomy, a three-way Foley-Alcock catheter was used (Fig. 5). Details of radium treatment are shown in Figure 9. Painful spasm while the balloon was in the bladder necessitated several interruptions of treatment. Three treatments were given over a total of twenty-three days.

The radium reaction was unduly severe. There resulted an ulcer 2.5 cm. in diameter, with sloughing at the site of the lesion. The attendant cystitis was of the most severe type possible and lasted one year after which the slough was removed with a cystoscopic rongeur. The cystitis promptly cleared, and at present the patient is free of disease and asymptomatic.

Comment: In addition to arresting the primary tumor (since April 22, 1946), the

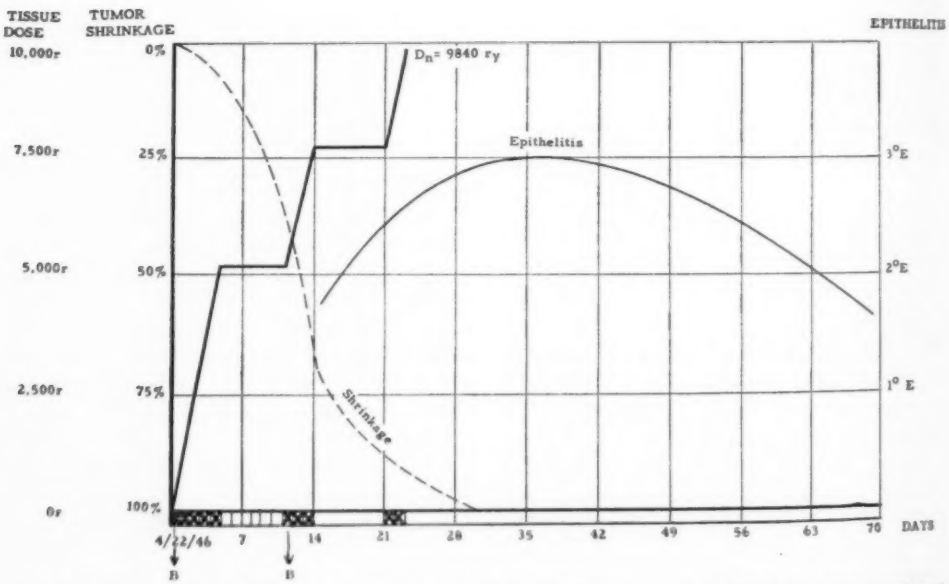

Fig. 9. Case 1. Chart illustrating treatment. Painful bladder spasm necessitated three radium treatments. The tissue dose to the surface of the bladder was 9,840 r_γ in twenty-three days. Evaluation of tumor shrinkage is based on cystoscopic visualization and is inexact. However, serial biopsy (indicated by the letter "B" at bottom of the chart) on the twelfth day after a dose of 5,200 r_γ showed almost complete tumor destruction. A large over-all total dose was subsequently given because of the submucosal infiltration of the primary tumor. The patient is now free of disease. Epithelitis of the bladder mucosa reached a third degree intensity at the site of the primary tumor and resulted in a prolonged, painful ulcer.

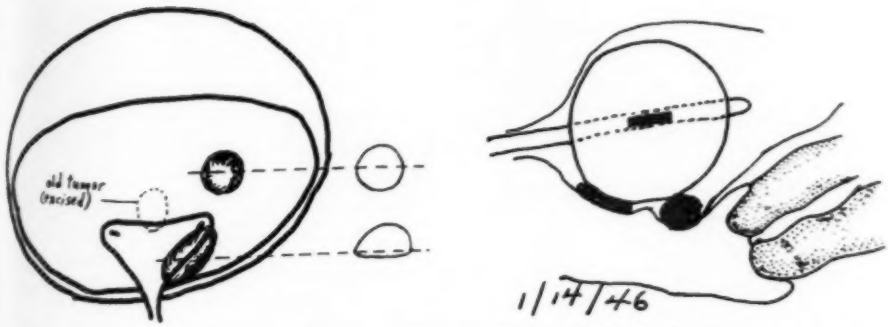

Fig. 10. Case 2. Two recurrent carcinomata, undifferentiated, infiltrating, histologic grade 3. They were palpable through the anterior vaginal wall.

radium destroyed three papillomata. No new or recurrent papilloma has appeared. This suggests the usefulness of the Walter Reed technic for multiple papillomatosis and prophylactic treatment of papilloma diathesis.

This patient sustained the most severe post-radium ulcer in the series, with incapacitating painful spasm lasting almost one year. This was probably due to extensive preliminary electrocoagulation, and might have been anticipated in the light of the painful spasm evoked by the inflated balloon in the bladder. In addition, the tissue dose was very large.

CASE 2: O. S., female, aged 47. Undifferentiated carcinoma, infiltrating, grade 3, with squamous metaplasia.

The original tumor was a nodule on the interureteric ridge, 1.0 cm. in diameter, without ulceration, palpable through the vaginal wall. This primary tumor was resected transurethrally in September 1945. Microscopic examination showed sheets and

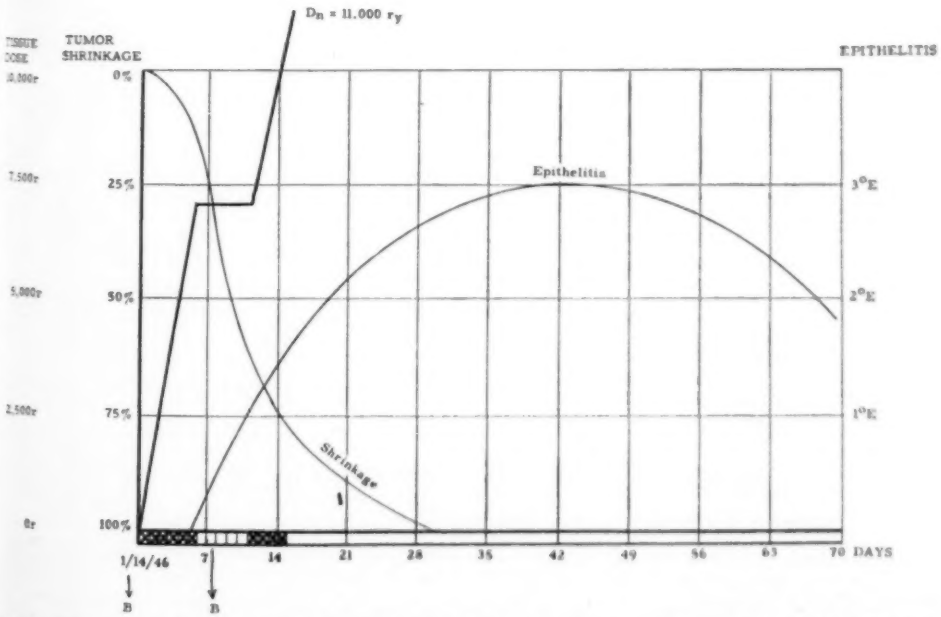

Fig. 11. Case 2. Treatment. A very large total dose of 11,000 r_Y was given because of the highly malignant nature of the tumor. The serial biopsy on the eighth day revealed only necrotic tissue.

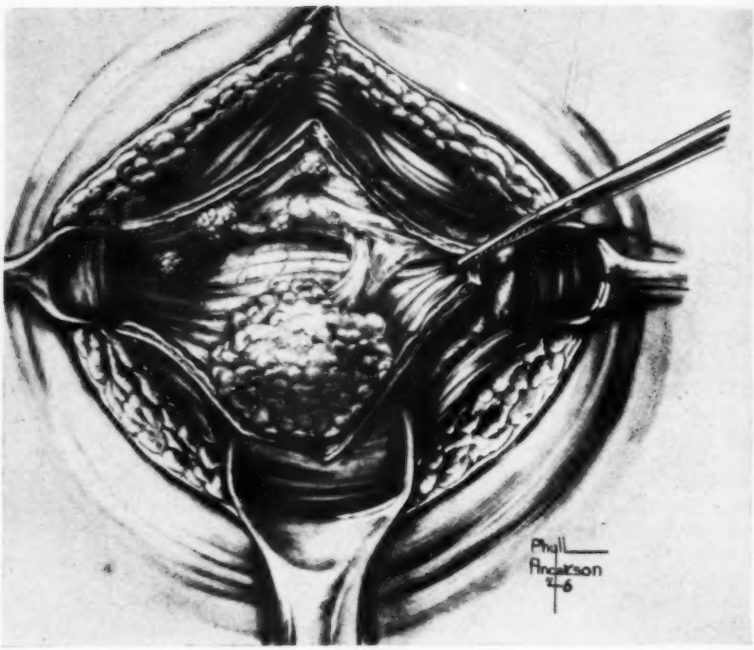

Fig. 12. Case 3. Multiple (5) papillary carcinoma. The largest lesion, 7 cm. in diameter, was pedunculated and was resected. The four other lesions were not touched. They looked grossly more like papillary carcinoma than papilloma. For radium treatment, see Figs. 1 and 13.

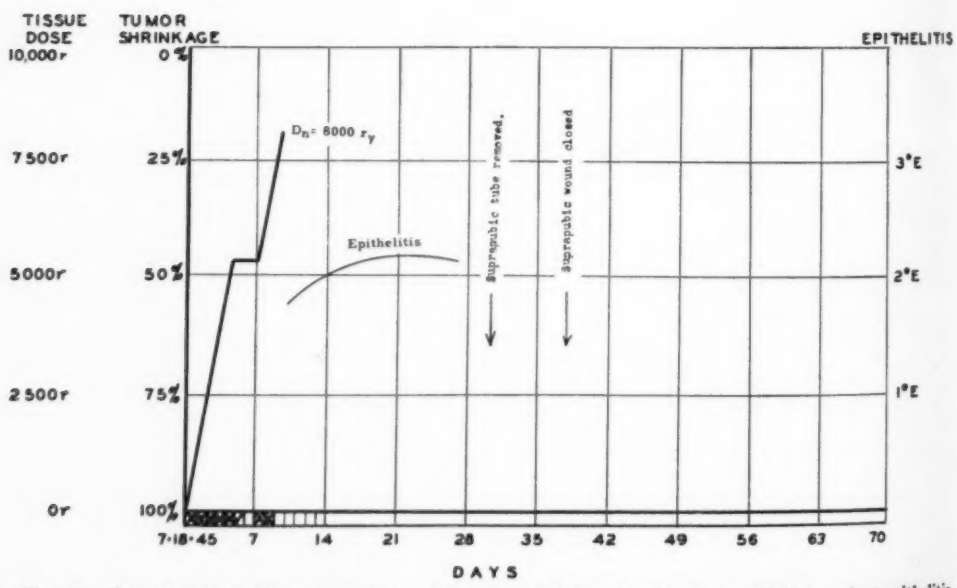

Fig. 13. Case 3. Two radium treatments. Total dose 8,000 r_γ in nine days. Mild transient epithelitis. Clinical shrinkage could not be evaluated. Suprapubic drain removed on the thirtieth day. At present, bladder mucosa is almost normal in appearance.

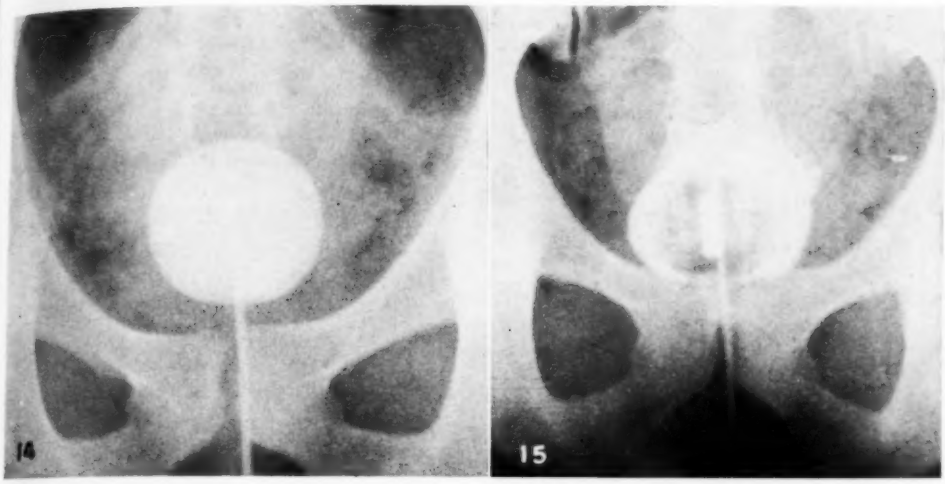

Fig. 14. Case 3. Radium in position. A two-channel catheter with cystotomy was employed.
Fig. 15. Case 3. For purposes of study, the balloon was filled with water, and sodium iodide was introduced suprapubically.

nests of cells; large cells with large, bizarre, hyperchromatic nuclei; frequent mitoses; no papillary arrangement. Three months later, pain, frequency, and hematuria recurred. At this time two new lesions were seen (Fig. 10). The lower one was palpable through the vagina. An intravenous pyelogram showed dilatation of the left ureter.

Radium was inserted Jan. 14, 1946, without cystotomy, with a three-way Foley-Alcock catheter. Treatment was given in two sessions of six and four days, respectively, for an over-all period of fifteen days (Fig. 11). The total exposure of 6,000 mg. hr. delivered a tissue dose to the surface of the bladder of 11,000 r_γ. At the time of the second radium insertion there was approximately 33 per cent clinical shrinkage observed cystoscopically. Biopsy showed necrotic tissue. The radium applicator was tolerated comfortably except for frequent blockage of urinary drainage (Fig. 6) and increased urgency during the last two days.

Radium reaction commenced one month after the first treatment, in the form of severe frequency and urgency, with urination every hour. The reaction was very intense for two weeks, becoming moderate and finally mild in intensity over a period of several more months. Cystoscopy in July 1948 disclosed focal areas of telangiectasis over the entire bladder wall. The ureteral orifices were normal. Intravenous pyelography showed that the left ureter had returned to normal. The sites of the three tumors were difficult to detect. Three years after the radium treatment, the bladder was still somewhat irritable, with mild frequency and nocturia. The bladder capacity was 250 c.c.

Comment: This was the second case treated in this series. Because of the virulent nature of the tumor, an unusually large dose of 11,000 r_γ was given. A tumor of this type probably should have received only 9,000 r_γ. In spite of the large dose (the largest in the series), the reaction was not as severe as would be expected.

CASE 3: R. N. W., male, aged 22 years. Papillary carcinoma, grade 2, multiple (5 lesions). Duration six months.

The largest lesion in this patient was 7 cm. in diameter, pedunculated, filling most of the bladder, and attached above the right ureteral orifice. The four other lesions ranged from 3 to 10 mm. in diameter (Fig. 12).

On July 18, 1945, through a suprapubic cystotomy, the large tumor was severed from its base electrosurgically. The four smaller tumors were not touched. Radium was inserted in two sessions (Fig. 13). The total exposure of 4,488 mg. hr. delivered a tissue dose to the surface of the bladder of 8,000 r_γ in ten days (Figs. 14 and 15).

The reaction was mild. A second degree epithelitis of the bladder mucosa was visible cystoscopically two weeks after the first radium treatment. This was practically asymptomatic and healed promptly. After three and one-half years, the working capacity of the bladder is 250 c.c.; under anesthesia, 600 c.c. Cystoscopic examination reveals a few focal areas of mild telangiectasis: the mucosa is otherwise normal.

Comment: Multiple superficial papillary carcinoma of the bladder is particularly amenable to treatment by the Walter Reed

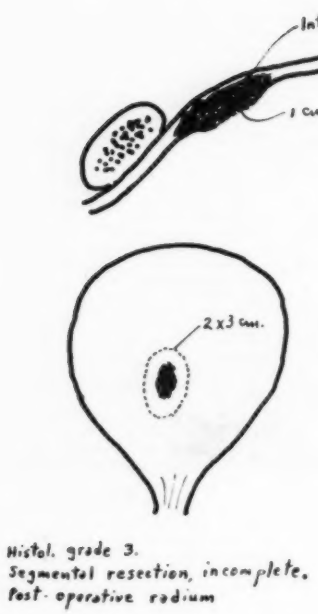

Fig. 16. Case 5. Infiltrating anaplastic carcinoma, histologic grade 3. A conservative segmental resection was followed by radium administered prophylactically.

technic. The reactions in this case were mild in spite of the large dose of 8,000 r_γ. This was the first case treated with the Walter Reed technic.

CASE 4: J. A. S., male, aged 52 years. Papillary carcinoma, grade 2. Duration three months.

On April 5, 1946, a small papillomatous tumor on the left lateral wall near the ureteral orifice was resected transurethrally. Histologic examination revealed "papillary projections of cells around a delicate fibrous core. The cells were atypical with markedly pleomorphic nuclei. Mitotic figures were frequent. There were occasional bizarre giant tumor cells." Resection was followed by painful cystitis.

On May 18, 1946, a cystotomy was done. With a two-way catheter, radium treatment was given in one session lasting seven days. The total exposure of 4,200 mg. hr. delivered a tissue dose to the surface of the bladder of 7,486 r_γ. There ensued a severe, painful cystitis lasting six months. This was due to breaking of the bag, discovered at the time of its removal, so that the radium capsule had been in close contact with the bladder mucosa for an unknown period. There later appeared an ulcer near the vesical orifice, not at the site of the tumor. The slough lasted six months. Cystoscopy one year later showed healing of the ulcer. Two and a half years later the patient still had moderate frequency without pain. He had gained twenty pounds. Cystoscopy disclosed moderate generalized radium telangiectasis, which was marked around the vesical orifice.

Comment: As mentioned above, in order to detect a collapsed bag, methylene blue is added to the solution injected into the bag. Its leakage permits immediate detection of this accident.

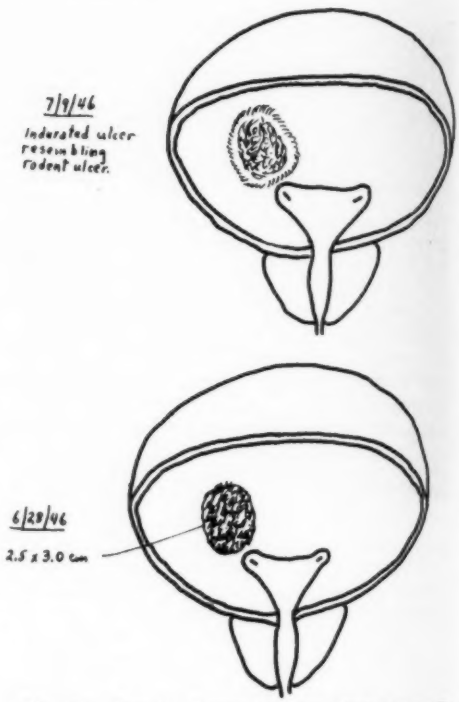

Fig. 17. Case 6. Lower diagram illustrates sessile papillary carcinoma which was superficially coagulated. Upper diagram illustrates lesion eleven days later, at time of cystotomy and radium insertion. It is now an indurated, craterous ulcer, lined with red tumor granulations.

CASE 5: R. A. Y., male, aged 33. Carcinoma of the bladder, transitional-cell, infiltrating, grade 3, postoperative residuum. Onset December 1945 with hematuria.

In April 1946, a sessile tumor, 1.5 × 3.0 cm., on the anterior bladder wall near the symphysis pubis was resected segmentally (Fig. 16). Microscopic examination showed "sheets and cords of atypical epithelial cells, numerous mitoses, bizarre hyperchromatic cells, and deep invasion of the muscular wall."

Because of the infiltrative nature of the lesion and high probability of local recurrence, radium therapy was instituted one week after resection. The radium

was inserted in two sessions of four and five days each, with an interval of ten days. The total exposure of 5,400 mg. hr. delivered a tissue dose of 9,625 rγ during an over-all period of nineteen days. The reaction was mild and healing uneventful. At present, the bladder mucosa is normal and the capacity is almost normal.

Comment: The high incidence of recurrence warrants prophylactic irradiation following conservative segmental resection of a highly malignant infiltrating carcinoma of the dome.

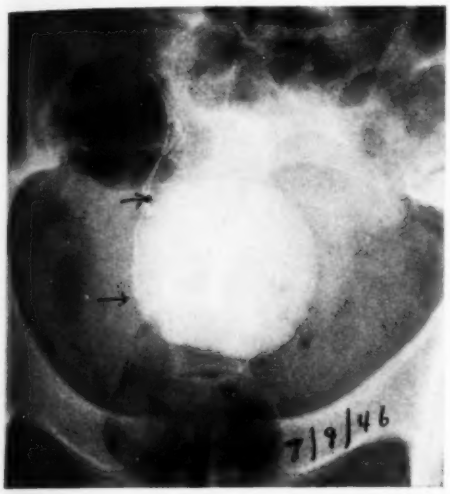

Fig. 18. Case 6. To outline the tumor for radiographic study, a tantalum wire was sewed, in purse-string fashion, around the periphery of the tumor (between two arrows). The ends of the wire extended out through the suprapubic opening. Note the excellent apposition to the surface of the balloon.

CASE 6: J. P. Z., male, aged 30. Papillary carcinoma, grade 2, sessile with early infiltration of submucosa above right ureteral orifice (Fig. 17). Duration of symptoms two months.

Transurethral biopsy and partial fulguration were done July 9, 1946, and the tumor was demarcated by a tantalum wire sutured around the margin (Fig. 18). Radium was given in one continuous session lasting ten days. The radium-tissue distance was great (2.4 cm.), and the filtration was high (1.3 mm. platinum). Hence the daily tissue dose was only 760 rγ. The total exposure of 6,000 mg. hr. delivered a total tissue dose of 7,690 rγ in ten days to the bladder wall.

At present, more than two and a half years later, the bladder capacity is 550 c.c. and there is very mild telangiectasis at the tumor site. There are no symptoms.

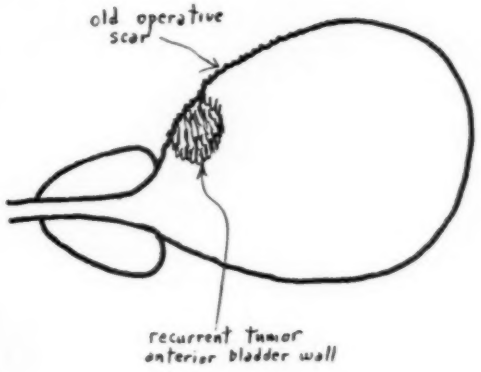

Fig. 19. Case 7. Second local recurrence (third lesion) of an infiltrating and papillary carcinoma on the anterior bladder wall. This was excised for a third time, and three days later radium was applied.

Comment: A sessile papillary carcinoma is ideally suited for this treatment technic.

CASE 7. R. W., male, aged 55 years. Infiltrating carcinoma of the anterior bladder wall, grade 2, second local recurrence.

The original tumor was coagulated in December 1944. The first recurrence was excised suprapubically in January 1946. The second recurrence was seen in October 1946 and excised suprapubically on Jan. 9, 1947 (Fig. 19). Histologic examination of the removed tumor showed "papillary carcinoma, grade 2, with fusion of papillae, pleomorphism and slight to moderate mitosis."

Three days after the last excision, radium was applied. A single treatment lasting five days, with an exposure of 3,000 mg. hr., delivered a tissue dose of 5,400 rγ to the bladder wall. There was very slight post-radium reaction. At present the bladder capacity is 350 c.c. and there is no ulceration or telangiectasis.

Comment: The recurrence of this tumor twice at the same site prompted prophylactic irradiation.

CASE 8. J. D., aged 56, male. Papillary carcinoma, grade 2, sessile, three weeks duration.

The tumor was located on the left lateral wall, extended down into the vesical neck, and measured 4.0 × 3.0 × 2.0 cm. (Fig. 20). Cystograms showed a large filling defect of the left base of the bladder with contracture of the bladder wall at its base (Fig. 21).

Cystotomy was performed on May 15, 1947. The lesion was not coagulated. Radium was applied in two sessions of four days each, with an interruption lasting three days. The total exposure of 5,800 mg.

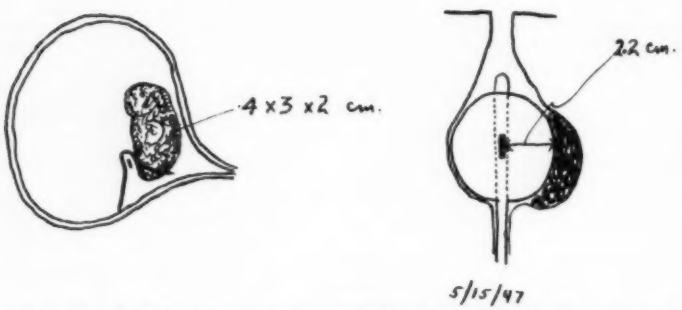

Fig. 20. Case 8. Broad, sessile, papillary carcinoma, grade 2, on left lateral wall of vesical neck. Lesion was not coagulated. Diagram on the right illustrates relation of lesion to radium applicator.

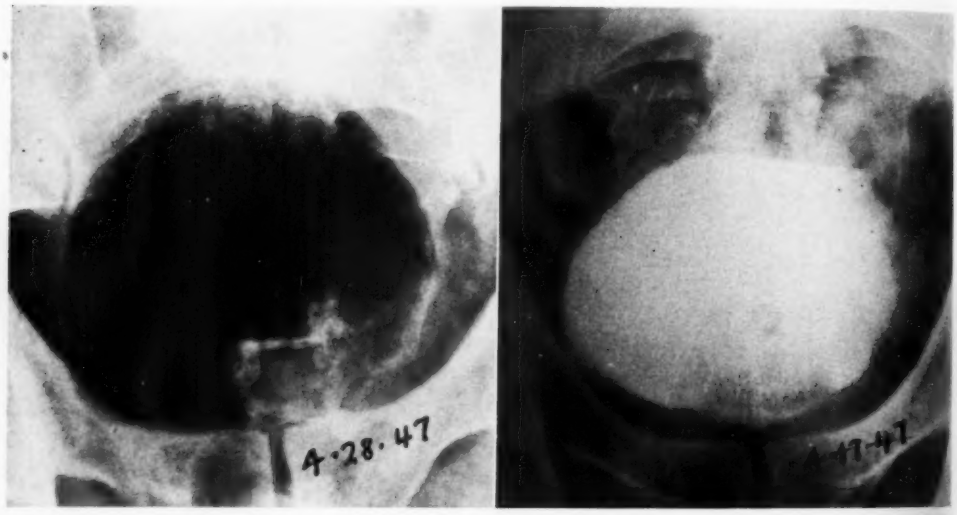

Fig. 21. Case 8. Air and contrast cystograms before treatment. Note large size and extent of the tumor.

hr. delivered a tissue dose to the tumor and bladder wall of 7,380 rγ in eleven days (Fig. 22). The radium was tolerated without discomfort. A serial biopsy, taken just before the second radium treatment was given, showed complete destruction of the malignant component of the tumor; the residual benign papillomatous tissue showed moderate to marked radiation effects.

Cystoscopic examination four weeks after the radium was first inserted showed a pseudodiphtheritic membrane 3.0 cm. in diameter covering the tumor site. The adjacent mucosa was edematous. Four months later, the reaction had healed, and a cystogram revealed a normal bladder contour (Fig. 23).

At present there are no sequelae. The bladder functions normally. The bladder mucosa is normal except for two tiny telangiectatic spots at the tumor site.

Comment: This case illustrates the efficiency of the Walter Reed technic. The lesion was a large, sessile papillary tumor. The radium was tolerated with no discomfort, and the radium reaction was mild and transient. At present, the bladder functions normally, and the mucosa is almost normal in appearance.

CASE 9: L. H. B., male, aged 62 years. Infiltrating carcinoma, histologic grade 3, on the right side of the vesical orifice, 5 cm. in diameter, involving the entire right half of the vesical orifice and infiltrating the right lobe of the prostate deeply (Fig. 24). Duration of symptoms two months.

On Aug. 27, 1947, the tumor was excised together with a portion of the prostate and the base was fulgur-

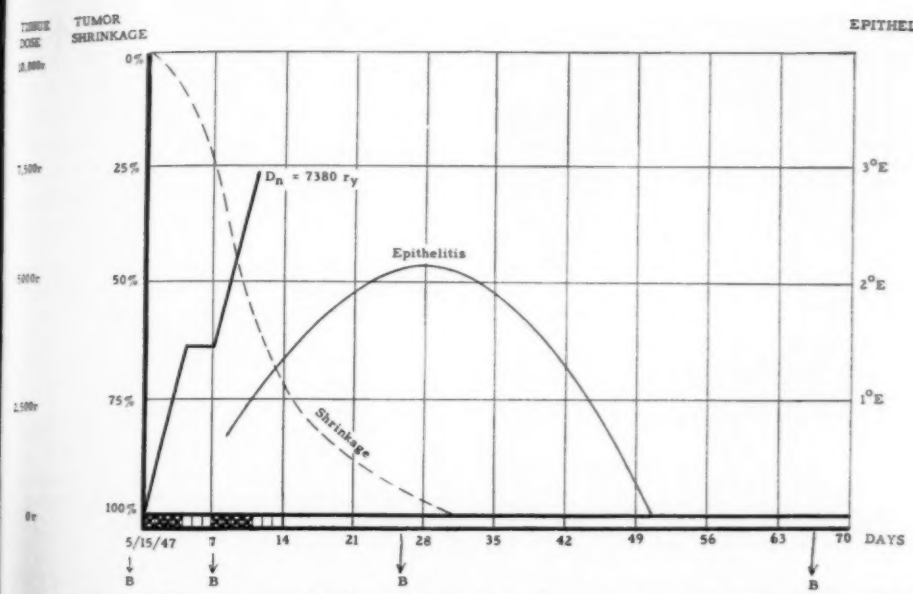

Fig. 22. Case 8. Tissue dose was 7,380 rγ in eleven days. Frequent cystoscopic examinations and serial biopsies permitted careful evaluation of the response of the tumor. Epithelitis was mild and transient.

Fig. 23. Case 8. Contrast cystogram four months after radium therapy. The bladder contours and capacity are normal.

Fig. 24. Case 9. Extensively infiltrating carcinoma of the neck of the bladder with deep invasion of the right lobe of the prostate.

ated deeply into the substance of the prostate. The same day radium was inserted. One treatment, lasting five days, was given. The exposure of 3,000 mg. hr. delivered a tissue dose of 5,340 rγ in five days. Histologic examination showed "strands and islands of infiltrating tumor cells; no papillary arrangement. Cells were fairly equal in size, with vesicular pale nuclei and moderate mitosis."

Because of the infiltrative nature and type of extension, additional irradiation was given with million-volt x-rays. A skin dose of 2,500 rγ was delivered to each of four skin portals, cross-firing the neck of the bladder. The additional tissue dose from x-rays was 4,634 rγ in twenty-eight days. The total tumor dose from both radium and x-rays was 9,975 rγ in thirty-seven days. There was mild reaction in the

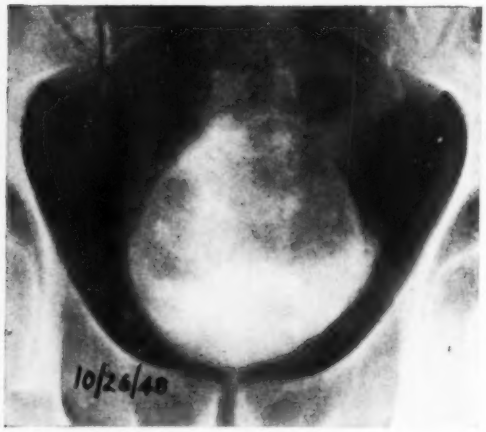

Fig. 25. Case 13. Multiple papillary carcinoma arising from seven different bases all over the bladder wall. The bases ranged from 1.5 to 3.0 cm. diameter. The luxuriant fronds aggregated a mass 8 cm. in diameter, completely filling the bladder.

form of rectal discomfort during the x-ray treatment. At present, bladder capacity is 500 c.c. and function is normal. There is mild radium telangiectasis in the prostatic urethra.

Comment: This is the only case in this series in which roentgen irradiation was added to the radium.

CASE 10: J. C., male, aged 69. Papillary carcinoma, grade 1. The tumor was a spherical papilloma, 2.5 cm. in diameter, with a base 1.0 cm. in diameter on the right lateral aspect of the vesical orifice.

On Oct. 8, 1947, the lesion was coagulated down to the base and radium was inserted for only one treatment. The exposure of 3,335 mg. hr. delivered a tissue dose of 6,280 r_γ in six days. The reaction was mild. One year later the bladder capacity was 150 c.c., with slight telangiectasis and a puckered scar at the tumor site, suggesting that the lesion may have extended deeper into the wall than was apparent.

CASE 11: R. G., male, aged 61 years. Infiltrating carcinoma of the bladder, grade 3, advanced. Duration of symptoms four years.

The tumor had been overlooked at several previous examinations elsewhere, because it was a flat infiltrating lesion. A cystogram showed marked fixation and a flat defect of the bladder wall.

The first radium treatment was uneventful. Because of the high degree of malignancy and marked extent of the tumor, it was decided to reopen the bladder for the second treatment in order to estimate the total dose properly. The patient died of cardiac decompensation on the day following this second operation.

Comment: Treatment of an advanced lesion may be undertaken with the Walter Reed technic providing the tumor is not too bulky. In spite of the hazard of too many operative shocks, it is still desirable to reopen the bladder for the second radium treatment in order to make an accurate decision as to the total dose necessary.

CASE 12: I. B., male, aged 72 years. Papillary carcinoma, grade 2 or 3, with infiltration of muscle, pleomorphism, and a moderate number of mitotic figures. The lesion was almost exactly like that in Case 10 except for a higher degree of malignancy and invasion. On June 25, 1948, the tumor was coagulated, probably too deeply into the bladder wall. Radium was applied in one session. An exposure of 3,600 mg. hr. delivered a tissue dose of 7,440 r_γ in six days. The reaction was severe and the ulcer persisted, with painful spasm for many months. There is now no evidence of tumor.

Comment: Unduly painful post-radium ulcer at the tumor site was probably due to coagulating too deeply into the bladder wall and to a rather large radium dose.

CASE 13: A. S., male, aged 45 years. Multiple papillary carcinoma, histologic grade 1 and 2, with luxuriant papillary fronds arising from seven bases ranging from 1.5 to 3.0 cm. in diameter, and aggregating a spherical mass of tumor tissue 7 cm. in diameter, completely filling the bladder (Fig. 25). In spite of this, symptoms were minimal.

On Oct. 27, 1948, the bladder was opened and the tumors were coagulated down to the bladder wall. A 100-c.c. balloon was used and inflated to a diameter of 5.0 cm. the largest employed in this series. The entire bladder wall was in contact with the bag except for the portion near the suprapubic drainage tube. The first radium treatment lasted six days. An exposure of 3,600 mg. hr. delivered a tissue dose to the surface of the bladder of 4,776 r_γ. Whereas the patient had been without pain before treatment, after coagulation and radium insertion the painful spasm was so intense that it was only partly controlled with morphine. This was probably due to the fact that coagulation extended deep into the bladder wall and the residual ulcers became infected, painful, and sensitive to the inflated bag. For the second treatment, a 100-millicurie radon tube was used for twenty-four hours. The exposure of 2,200 mc. hr. delivered a tissue dose of 2,924 r_γ in one day. The total dose was 7,700 r_γ in eighteen days (Fig. 26).

Subsequently, the painful spasm, frequency, and urgency abated slowly over a period of two months. Three months later, all ulcers had healed and the bladder mucosa looked only slightly inflamed. There has been no recurrence.

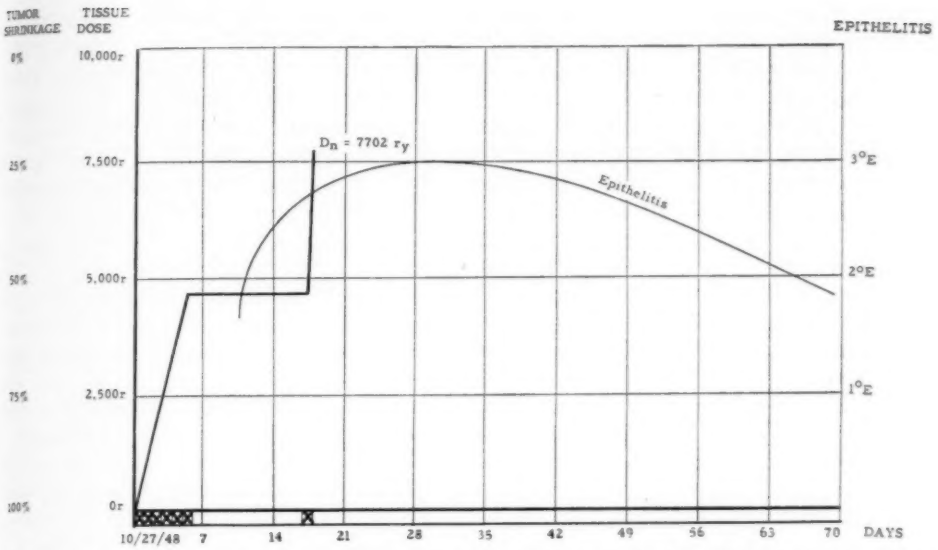

Fig. 26. Case 13. Because of the large radium-tissue distance of 2.5 cm., the first radium treatment required six days continuous exposure to deliver a tissue dose of 4,776 r_γ to the surface of the bladder. Extensive, preliminary electrocoagulation resulted in painful spasm during the first treatment. Consequently, in order to reduce the discomfort, a 100-mc. radon capsule was used during the second treatment. In one day an exposure of 2,200 mc. hr. delivered a tissue dose of 2,924 r_γ. The epithelitis was severe over the coagulated areas and required three months to heal.

Comment: This was the only case in the series where the entire bladder mucosa was irradiated with a very large bag. It illustrates the painful consequences of coagulating too deeply into the bladder wall. Nevertheless, widespread, massive, multiple, papillary carcinomas, which would ordinarily require cystectomy, were controlled.

DISCUSSION AND SUMMARY

The Walter Reed technic for the treatment of bladder carcinoma entails the following principles:

1. Iso-irradiation of the lower two-thirds of the bladder wall with gamma radiation by means of a small radium capsule held fixed in the center of the bladder by means of a Foley or Foley-Alcock catheter. (In an occasional extensive lesion, the bag may be sufficiently distended so that the entire bladder is irradiated.) This provides homogeneous irradiation of the tumor and bladder wall with minimal exposure of the surrounding viscera, because the short radium-tissue distance results in a rapid falling-off in radiation intensity outside the bladder.

2. Fractionation over a period of ten to twelve days. Although this is the recommended period of exposure, the duration of irradiation may range from five to fifteen days.

3. Treatment in two sessions with an interval of three to five days. This permits the bladder to rest and recover from pressure irritation. The irradiation time is prolonged so that the receding outer margin of the tumor is brought progressively closer to the radium, with consequent increased effectiveness of the later irradiation. At the time of the second radium insertion, cystoscopic visualization and biopsy permit accurate evaluation of the radiosensitivity of the tumor so that the dose can be regulated for each case.

This precise technic can produce predictable effects on the tumor and predictable reactions on the mucosa, providing the urologist and radiotherapist execute with infinite care all the features of the technic and dosage calculation described.

The following *indications* are offered tentatively because of the small number of cases treated and the relatively brief period of follow-up observation:

1. This method is particularly suitable for treatment of multiple papillary tumors and for new growths and recurrent tumors in the lower two-thirds of the bladder.

2. The tumor must be of such configuration and size that, at cystotomy, after the catheter has been inserted and the bag inflated, the entire tumor-bearing area can come in contact with the surface of the bag.

3. Removal of a highly malignant, infiltrating tumor of the vault, by segmental resection may profitably be supplemented by postoperative, prophylactic irradiation with the Walter Reed technic.

4. Bulky, extensive tumors which are more than 3.0 cm. thick will probably not respond well to this type of irradiation. We have not undertaken irradiation of these extensive, advanced carcinomas. It is possible, however, that palliative benefit may be achieved in some cases.

5. Recurrent benign papilloma of the bladder, whose clinical course portends successively more aggressive behavior, may warrant prophylactic irradiation with this technic. We have not yet undertaken this type of treatment, but the efficiency of the procedure prompts this recommendation. When dealing with a benign lesion, the post-coagulation ulcer should be permitted to heal before irradiation is undertaken. Irradiation can be administered transurethrally without the necessity of cystotomy.

The *contraindications* to the method are: previous irradiation of the bladder, primary tumors which can be completely removed by segmental resection, and advanced cancer.

A second biopsy to evaluate the effect of the first radium treatment is useful in approximately one-third of the cases. In the remaining cases there is insufficient tumor tissue for biopsy purposes or infection obscures the radiation effects.

In women with carcinoma of the bladder, supplementary irradiation can be obtained by the insertion of suitable radium applicators into the vagina if necessary.

Twelve of the first 13 patients treated by this technic are free of disease for ten months to four years.

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SUMARIO

Nueva Técnica para la Curieterapia del Carcinoma Vesical

En el Hospital Walter Reed de Wáshington han elaborado un nuevo método, denominado técnica Walter Reed, para la irradiación del carcinoma de la vejiga urinaria, que comprende los siguientes principios:

1. Isoirradiación de los dos tercios inferiores de la pared vesical con radiación gama por medio de una capsulilla de radio mantenida en el centro de la vejiga por un catéter de Foley o de Foley-Alcock. (En alguna que otra lesión extensa, la bolsa puede distenderse lo suficiente para irradiar toda la vejiga.) Esto facilita irradiación homogénea del tumor y de la pared de la vejiga con exposición mínima de las vísceras circundantes, por dar por resultado la corta distancia radio-tejido una rápida disminución de la intensidad de la radiación fuera de la vejiga.

2. Fraccionación durante un período de diez a doce días. Aunque éste es el tiempo de exposición recomendado, la duración de la irradiación puede variar de cinco a quince días.

3. Tratamiento en dos sesiones con un intervalo de tres a cinco días, lo cual da tiempo a la vejiga para reposar y reponerse de la irritación producida por la presión. El tiempo de irradiación es prolongado, de modo que se acerca gradualmente el desviado borde externo del tumor al radio, con el consiguiente aumento en eficacia de la irradiación subsiguiente. Al hacerse la segunda introducción de radio, la visualización cistoscópica y la biopsia per-

miten justipreciar la radiosensibilidad de la neoplasia de modo que puede regularse la dosis para cada tumor.

Comunícanse 13 casos en que se empleó esta técnica: 12 de estos enfermos han estado exentos de la enfermedad por períodos de seis meses a cuatro años. A base de esta pequeña serie, se sacan las siguientes conclusiones:

1. El método se presta en particular para el tratamiento de los papilomas múltiples y de las neoplasias recientes y tumores recurrentes en los dos tercios inferiores de la vejiga.

2. El tumor debe ser de tal configuración y tamaño que, en la cistotomía, después de introducir el catéter y de inflar la bolsa, toda la zona cancerosa pueda quedar en contacto con la superficie de la bolsa.

3. El asiento de un tumor infiltrante, muy maligno, de la bóveda, que ha sido extirpado por resección segmentaria, puede recibir con ventaja la irradiación profiláctica, postoperatoria con la técnica Walter Reed.

4. Los tumores voluminosos y difusos de más de 3 cm. de grueso probablemente no responderán bien a esta clase de irradiación, aunque es posible que se alcance efecto paliativo en algunos casos.

5. En el papiloma benigno recurrente de la vejiga, cuya evolución clínica denota comportamiento más agresivo después, puede estar justificada la irradiación profiláctica. Tratándose de una lesión benigna, hay que dejar cicatrizar la úlcera postcoagulación antes de emprender la irradiación. La irradiación puede administrarse transuretralmente sin cistotomía.

Las contraindicaciones consisten en: previa irradiación de la vejiga, tumores primarios que pueden ser extirpados totalmente con la resección segmentaria y cáncer avanzado.

Una segunda biopsia para valuar el efecto del primer tratamiento con radio resulta útil aproximadamente en la tercera parte de los casos. En los demás casos, o el tejido neoplásico es insuficiente para biopsia o la infección eclipsa los efectos de la curieterapia.

En las mujeres con carcinoma vesical, puede obtenerse irradiación complementaria, si fuere necesaria, mediante la introducción en la vagina de aplicadores adecuados de radio.

DISCUSSION

William Harris, M.D. (New York): Cancer of the urinary bladder has always presented a major challenge both to the urologist and radiologist. Subtotal cystectomy in suitable cases has resulted in some cures, but this limited operation is applicable in only a small percentage of the material. Radon implants, radium needles, and external irradiation have been found to be far from satisfactory. In spite of improved surgical technics and lowered mortality, total cystectomy is far from the ideal which we seek, especially in view of the serious renal complications which result from ureteral implantations either in the skin or bowel. We therefore welcome any new approach to the problem which may offer the patient greater hope of cure or even greater palliation than was previously possible. Dr. Friedman has presented a new radium technic for this purpose and has employed it for three years on a small number of patients and therefore rightfully calls this a preliminary report.

Our first patient was treated with radium in a Foley bag on May 10, 1946, for transitional-cell carcinoma obstructing a ureteral orifice. The radium was preceded by x-ray treatment, directed to the bladder, giving an estimated dose of 5,900 r to the lesion in the bladder mucosa. This was followed by a radium dose of 6,000 r 0.5 cm. from the surface of the bag and 4,300 r to the lesion. In September 1948 there was no evidence of disease but the patient had a stricture of the posterior urethra.

We have treated 20 patients thus far with the Foley bag technic. Our material is not comparable with Dr. Friedman's because most of our patients had been previously treated either by fulguration, radon seed implantations, or x-ray therapy, and for these reasons the effectiveness of the bag treatment alone cannot be assessed at present. We have not used the suprapubic approach except in a few patients where the bag could not be introduced through the urethra. We have not done serial biopsies because we do not believe that this procedure will indicate the maximum amount of treatment that should be given. This will be determined by the amount

that the bladder wall will tolerate. It may, however, in view of Spear and Glucksmann's work, indicate whether one will be successful with radiotherapy.

There have been many difficulties encountered with the use of the Foley bag as a radium carrier. Many bags must be tried out before a symmetrical one can be obtained. We use bags of 40 c.c. capacity, filled with 30 c.c. of fluid colored with methylene blue. Rupture of the bag can be readily detected by discoloration of the urine. A 50-mg. source of radium element was used in the last 12 cases. The reactions from this intense source were too severe, if a continuous treatment of four to five days was given. We plan in the future to lengthen the over-all treatment time by at least a week and use two applications as Dr. Friedman has done. Homogeneous irradiation of the entire bladder is impossible with the bag as it is now available, because of the long tip at the end, and in the case of bulky lesions.

Studies with sodium iodide with the bag in place have indicated that there is often significant movement and asymmetry of the bag during treatment, and this makes for considerable error in the calculated dose. This can be easily seen on study of the isodose curves in this set-up, when a change in distance of 0.5 cm. may throw the calculated dose off 36 per cent in either direction. The question of use of a smaller source of radium for homogeneity should also be studied.

There is a great deal of development necessary before this method of treatment can be universally recommended and used. Dr. Friedman is to be congratulated on his achievements with this new technic, and I hope that it will prove, as time goes on and experience increases, to be the answer to this great problem which confronts us. At present I should recommend its use in all trigonal lesions where total cystectomy is the only alternative.

Dr. Friedman (*closing*): There is a minor friendly rivalry between Dr. Harris and me which may account for the way we specify the dates we each gave the first treatment. Although we anticipated Dr. Harris, he arrived at this technic totally independent of us and is deserving of equal credit. Serial biopsies were useful in one-fourth of our cases. In other cases there was no tissue available for biopsies. I think they are very helpful because of the desirability of determining the giving of 5,000 or 6,000 gamma r, with no cystitis, or 8,000, 9,000, or 10,000 gamma r, which will bring about painful cystitis.

Dr. Harris mentioned the fact that the technic will probably entail giving the maximum dose the bladder wall will tolerate. As I indicated in the statement regarding serial biopsy, it may not be necessary. I think the idea of using methylene blue is an excellent one and will obviate taking frequent radiographs. We shall adopt it and mix the dye with sodium iodide.

A Method for Measuring Children's Hearts

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RECENTLY (1) I DESCRIBED a method and presented a nomogram for facilitating adult heart measurement from the teleroentgenogram. That nomogram is not applicable to children because in the child the formula for predicting normal frontal plane area from height and weight is somewhat different from that for the adult (2). It is possible by the addition of two more scales to include both adults and children in a single nomogram, thus providing for both adult and childhood height-weight prediction formulae. There are two chief objections to this: (1) The nomogram would be more complicated and, therefore, more difficult to read. (2) The line drawn to compare predicted and measured frontal plane areas tends to become more closely parallel to the percentage scale line as the values for cardiac area become smaller. If the angle made by this line connecting the frontal plane area scales with the percentage scale is too acute, an accurate percentage reading becomes very difficult. In order to make this relationship more favorable for the smaller cardiac areas of children, a special nomogram must be constructed.

The same steps are required in making the heart size nomogram for children as for adults. One must obtain (*a*) an average distortion correction factor which can be applied to all subjects and (*b*) an average correction factor which, when multiplied by the product of the long and short heart diameters, will give a figure corresponding to the cardiac frontal plane area.

One hundred children varying in age from three to sixteen years were selected for this study (Table I). The divergent distortion factor was calculated for each subject under standard conditions. In all cases a 72-inch focal spot film distance and the position of the patient, upright with the anterior surface of the chest closest to the film, were the constants. The only variable was the distance of the heart from the film which, of course, was determined by the anteroposterior diameter of the chest. As shown in the table, the divergent distortion correction factor varied only between 0.89 to 0.93, despite the wide range of anteroposterior chest diameters, which extended from 11.5 to 22.0 cm. The average and mean divergent distortion factor, 0.91, could therefore be applied to all subjects, which, at most, could give an error of only 2 per cent of the total frontal plane area.

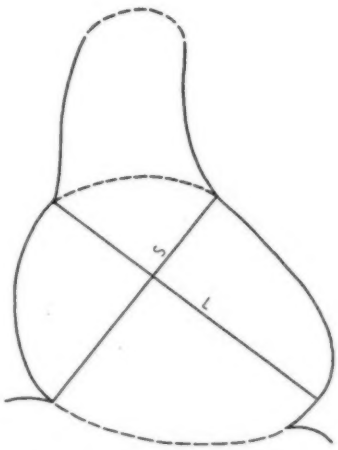

Fig. 1. Complete cardiac silhouette showing how the long and short diameters are drawn. In actual practice, the measurements are made directly on the chest film; the heart shadow is not traced, so the empiric upper and lower borders are omitted (broken lines).

The long diameter, L, is drawn from the right cardiovascular junction to the left apex. The short diameter, S, is drawn from the junction of left heart border and pulmonary conus to the right cardiophrenic angle.

The correction factor which, when multiplied by the product of the long and short cardiac diameters, will yield a close approximation of frontal plane area was obtained by the following formula:

[1] From the Division of Roentgenology, The University of Chicago, Chicago, Ill. Accepted for publication in July 1948.

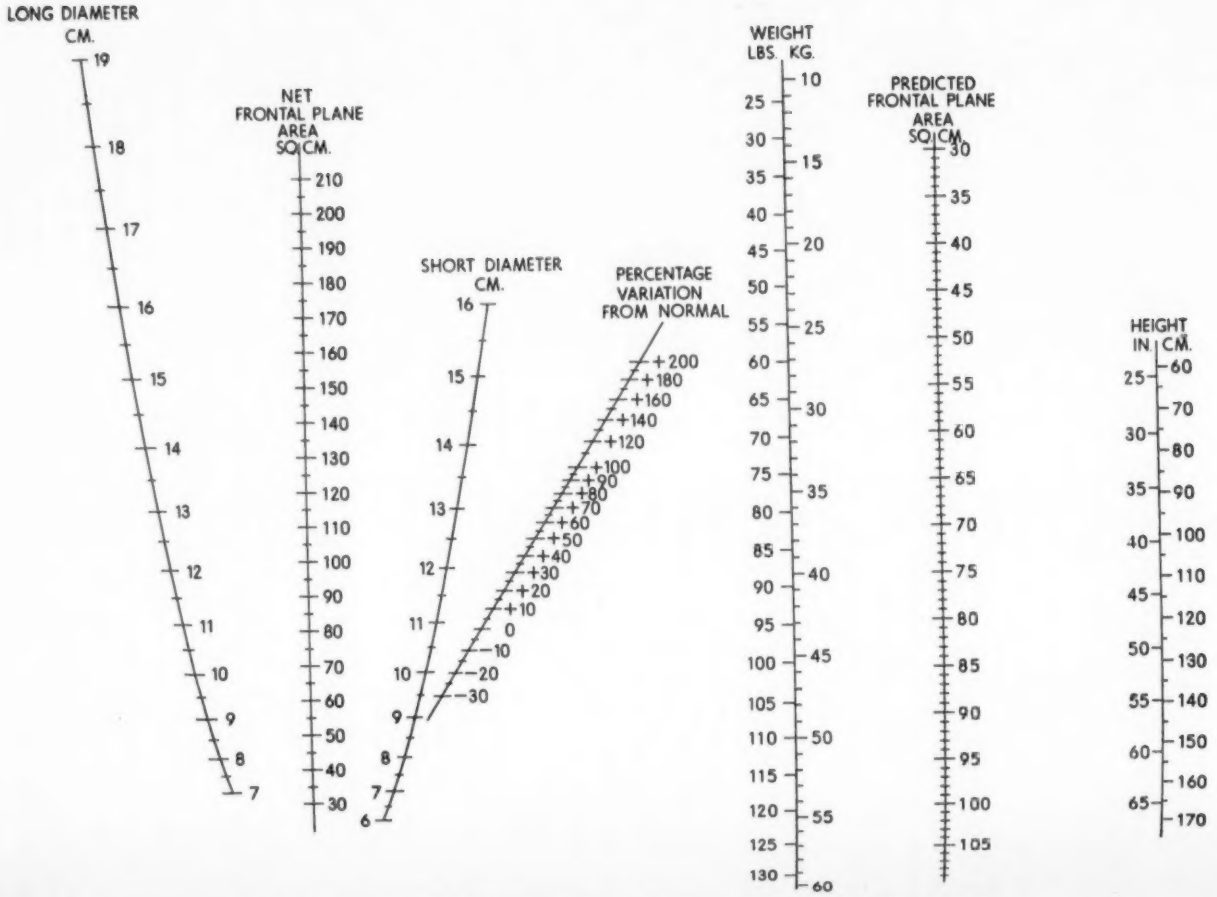

Fig. 2. Children's Heart Size Nomogram. For explanation see foot of opposite page.

$$\frac{Agp}{L \times S} = F$$

where

Agp = gross frontal plane area in sq. cm., measured by a planimeter tracing of the cardiac silhouette
L = long diameter in cm.
S = short diameter in cm.
F = correction factor

A planimeter tracing of the cardiac silhouette was made for each of the 100 children and the correction factor was obtained by the above formula. The average correction factor 0.75 was determined by dividing the total by 100. Therefore, the resulting equations will be

(1) $L \times S \times 0.75 = Ag$
(2) $L \times S \times 0.75 \times 0.91 = A$, or
$L \times S = 0.68$

where

L = long diameter of the heart shadow
S = short diameter of the heart shadow
Ag = gross frontal plane area
A = net frontal plane area

The resulting equation (2) is virtually the same as the adult formula.

The predicted frontal plane area is based on the subject's height and weight. The children's formula for frontal plane area, proposed by Hodges, Gordon, and Adams (2) is:

$$0.180H + 1.045W + 13.7$$

where

H = subject's height in cm.
W = weight in kg.

The long and short cardiac diameters are drawn in exactly the same way as for adults (Fig. 1). The long diameter, L, is drawn from the junction of the right heart border and great vessels to the cardiac apex, and the short diameter, S, from the junction of the left heart border and pulmonary conus to the right cardiophrenic angle. The heart is considered suitable for measurement only if the cardiac apex is visible and the position of the right diaphragm is normal in relation to the left.

The nomogram (Fig. 2) is used in the following manner: points from which the diameters are drawn are marked with a wax pencil directly on the chest film; the long and short diameters are measured with a transparent centimeter ruler. These values are transferred to the nomogram, the ruler is placed across the scales for long and short diameter, the net frontal plane area read where the ruler intersects that scale. Next, the ruler is placed across the scales for body weight and stature; the predicted frontal plane area is read where the ruler intersects that scale. Finally, the ruler is placed so that it connects the values for net and predicted frontal plane area, the percentage variation from normal being read from the sloping center scale at the point intersected by the ruler. A heart measuring up to +10 per cent is considered normal in size.

For accurate use of the nomogram, the following conditions are required:

(1) The subject should not be younger than three years[2] or older than sixteen

[2] The children's height-weight prediction formula (2) was derived from a series of normal children, the youngest being approximately three years old. It would therefore be hazardous to assume that the formula could also be closely applied to children younger than this. As far as I know, no standard for predicting normal frontal plane area of the heart for children under three years has been devised.

Fig. 2. Children's Heart Size Nomogram. For explanation see foot of opposite page.

Explanation of Nomogram

The nomogram is applicable only to children between the ages of three and sixteen years, inclusive. If the stature is greater than 170 cm., use the adult nomogram (1). The chest film must be taken with the anterior chest surface next to the film at a target-film distance of 72 inches.

The long and short diameters are measured directly on the chest film with a transparent centimeter ruler. The values are transferred to the nomogram, the ruler is placed across the scales for *long* and *short diameters*, the *net frontal plane area* being read where the ruler intersects that scale. Next, the ruler is placed across the scales for *body weight* and *height* and the *predicted frontal plane area* is read where the ruler intersects that scale. Finally, the ruler is placed so that it connects the values for *net* and *predicted frontal plane area*, the *percentage variation from normal* being read on the sloping center scale at the point intersected by the ruler.

Photostatic copies of this nomogram, 14 × 17 inches, may be obtained from the University of Chicago Bookstore, 5802 Ellis Ave., Chicago 37, Ill., at $1.50 each.

TABLE I: CHILDREN'S HEARTS, NORMAL AND ABNORMAL (*Contd.*)

1	2	3	4	5	Planimeter Method		Diameter Method									
					6	7	8	9	10	11	12	13	14	15	16	17
X-ray or Unit No.	Age (yr.)	Height (cm.)	Weight (kg.)	AP Chest Diameter (cm.)	Cross Area (sq. cm.)	Divergent Distortion Correction Factor	Net Area (sq. cm.)	Long Diameter (cm.)	Short Diameter (cm.)	L × S*	Agp/L × S†	Net Area (sq. cm.)	Predicted Area (sq. cm.)	Percentage Variation from Normal Planimeter Method	Percentage Variation from Normal Diameter Method	Percentage Variation of Diameter Method from Planimeter Method
76,318	8	134	27.2	14.0	95	0.92	87	12.5	10.0	125.0	0.760	85	66	32	30	−2.30
78,042	9	137	38.3	15.0	107	0.91	97	13.2	11.0	145.0	0.740	99	68	42	45	+2.31
78,588	12	108	28.4	13.5	81	0.92	75	11.2	9.9	111.0	0.730	76	63	19	20	+1.33
79,958	12	157	48.0	16.0	103	0.91	94	14.1	10.7	151.0	0.680	102	92	2	11	+8.51
81,795	12	146	38.6	16.0	108	0.91	98	12.7	11.4	145.0	0.745	98	80	23	23	0
82,214	11	145	31.0	16.0	95	0.91	86	12.4	9.6	119.0	0.800	81	72	19	13	−5.81
82,509	6	120	20.7	14.0	83	0.92	76	11.4	9.3	106.0	0.780	72	57	30	27	−5.26
79,883	5	102	14.5	11.5	52	0.93	48	9.2	8.0	74.0	0.700	50	47	2	7	+4.16
79,958	12	157	48.0	16.0	103	0.91	94	14.1	10.7	151.0	0.680	103	92	2	11	+9.56
79,976	9	136	29.4	15.5	89	0.91	81	12.4	9.6	119.0	0.750	81	69	18	18	0
77,252	14	150	32.0	18.5	183	0.90	165	15.8	14.2	224.0	0.815	152	74	+122	+105	−7.89
86,766	9	137	27.0	17.5	89	0.90	80	12.0	9.8	118.0	0.755	80	67	+20	+20	0
89,086	13	128	22.6	16.0	87	0.91	79	12.2	9.7	117.0	0.745	81	60	+31	+35	+2.53
73,564	16	165	58.7	17.0	97	0.91	88	12.0	10.5	126.0	0.770	86	105	−15	+18	−2.27
72,634	13	163	42.0	17.5	151	0.90	137	15.4	12.9	199.0	0.760	135	87	+58	+55	−1.46
44,469	7	106	21.4	15.0	51	0.91	47	9.2	7.3	67.0	0.760	46	55	−15	−16	−2.12
45,116	11	140	30.0	15.5	70	0.91	64	10.4	8.6	89.0	0.790	61	70	−8	−12	−4.70
45,380	5	114	20.0	15.5	63	0.91	58	10.0	8.6	86.0	0.730	59	55	+5	+7	+1.72
45,463	14	162	52.4	21.0	115	0.89	102	13.5	11.1	150.0	0.765	102	98	+5	+5	0
45,562	7	115	20.0	15.0	83	0.91	76	12.1	9.5	115.0	0.720	78	55	+36	+42	+2.63
46,202	8	122	20.0	16.0	61	0.91	55	9.8	8.1	79.5	0.770	54	57	−2	−5	−1.82
46,673	11	150	33.6	18.5	98	0.90	88	12.5	10.5	131.0	0.750	89	76	+15	+18	+1.14
47,021	12	139	30.2	18.0	133	0.90	120	15.2	12.4	188.5	0.705	128	70	+70	+82	+6.65
47,201	6	114	18.0	14.0	62	0.92	57	9.8	8.0	78.5	0.790	53	53	+8	0	−7.01
47,371	13	154	35.2	19.5	104	0.90	94	13.0	10.7	139.0	0.750	95	78	+20	+22	+1.06
47,417	7	114	21.0	15.5	72	0.91	66	11.0	9.1	101.0	0.710	68	56	+18	+22	+3.03
48,600	9	133	28.6	17.0	70	0.91	63	10.7	8.6	92.0	0.760	62	68	−7	−8	−1.59
50,987	7	131	30.7	17.0	68	0.91	62	10.5	9.3	98.0	0.695	66	69	−10	−4	+6.45
47,603	7	124	20.7	15.5	130	0.91	118	14.8	11.6	172.0	0.755	117	58	+105	+102	−0.85
49,302	9	153	29.6	17.0	82	0.91	74	11.9	9.1	108.0	0.760	73	69	8	7	−1.35

TABLE 1: CHILDREN'S HEARTS, NORMAL AND ABNORMAL

1	2	3	4	5	Planimeter Method			Diameter Method					14	15	16	17
X-ray or Unit No.	Age (yr.)	Height (cm.)	Weight (kg.)	AP Chest Diameter (cm.)	6 Gross Area (sq. cm.)	7 Divergent Distortion Correction Factor	8 Net Area (sq. cm.)	9 Long Diameter (cm.)	10 Short Diameter (cm.)	11 L × S*	12 Agp/L × S†	13 Net Area (sq. cm.)	Predicted Area (sq. cm.)	Percentage Variation from Normal Planimeter Method	Percentage Variation from Normal Diameter Method	Percentage Variation of Diameter Method from Planimeter Method
76,043	6	122	25.1	16.0	74	0.91	68	10.9	9.3	101.5	0.730	69	62	+ 9	+ 11	+1.47
27,736	11	154	36.6	18.5	78	0.90	70	11.0	9.7	108.0	0.720	73	80	− 11	− 9	+4.29
38,318	15	147	50.0	19.0	117	0.90	106	14.0	10.9	152.5	0.770	104	85	+ 24	+ 22	−1.88
38,706	4	99	14.4	12.5	47	0.92	43	9.4	7.3	68.5	0.685	46	47	− 6	− 2	+6.95
39,123	9	116	19.5	14.5	63	0.92	58	9.6	9.1	87.0	0.725	59	54	+ 9	+ 10	+1.88
39,535	11	131	23.8	17.5	192	0.91	174	16.2	14.3	232.0	0.825	158	62	+178	+154	−1.09
39,611	8	122	19.7	15.0	50	0.91	46	8.7	7.3	63.5	0.790	43	56	− 18	− 23	−6.53
39,620	14	158	38.7	18.0	68	0.90	61	10.6	9.3	98.5	0.690	67	82	− 25	− 18	+9.85
41,137	10	135	27.6	14.5	69	0.92	63	10.5	8.9	93.5	0.740	63	67	− 5	− 5	0
39,598	13	145	36.2	15.5	91	0.91	83	11.8	9.6	113.0	0.805	77	78	+ 6	− 1	−7.23
41,119	11	138	28.6	16.0	93	0.91	84	11.8	10.5	124.0	0.750	84	68	+ 24	+ 24	0
41,453	11	142	35.0	17.5	69	0.91	62	11.1	8.3	92.0	0.750	62	76	− 17	− 17	0
41,838	4	105	15.7	13.5	58	0.92	53	9.9	7.3	72.0	0.805	49	49	+ 8	0	−7.55
42,046	10	130	25.0	16.5	75	0.91	68	11.2	9.2	102.0	0.735	70	63	+ 8	+ 11	+2.94
42,267	12	151	37.0	19.5	129	0.90	116	13.3	12.3	163.5	0.790	111	80	+ 45	+ 40	−3.20
43,059	5	99	18.5	16.0	67	0.91	61	11.1	8.1	90.0	0.745	61	51	+ 20	+ 20	0
43,403	3	104	17.0	13.5	52	0.92	48	9.2	7.7	71.0	0.730	48	49	− 2	− 2	0
9,981	13	147	33.0	16.0	76	0.91	69	11.8	9.1	107.0	0.710	73	75	− 7	− 3	+5.80
31,112	4	99	16.3	13.0	58	0.92	54	10.1	7.3	74.0	0.785	50	48	+ 11	+ 5	−7.41
31,245	7	120	21.5	15.5	61	0.91	56	10.0	8.2	82.0	0.745	56	58	− 3	− 3	0
31,666	5	118	21.0	15.0	56	0.91	51	9.5	7.8	74.0	0.755	50	57	− 9	− 11	−1.96
32,047	4	104	16.5	13.5	58	0.92	53	9.8	7.8	76.5	0.760	52	49	+ 8	+ 7	−1.89
32,101	11	155	41.7	16.0	118	0.91	107	14.5	11.2	162.0	0.730	110	85	+ 25	+ 30	+2.81
32,259	13	154	40.4	19.0	92	0.90	83	12.4	10.3	128.0	0.720	87	84	− 1	+ 4	+4.82
32,353	6	123	23.5	16.0	73	0.91	66	11.0	8.6	94.5	0.770	65	60	+ 9	+ 8	−1.54
33,056	3	103	16.4	14.0	59	0.92	54	9.9	7.7	76.0	0.775	52	49	+ 10	+ 7	−3.71
10,551	14	168	56.0	18.5	109	0.90	98	12.4	11.6	144.0	0.760	98	102	− 4	− 4	0
31,830	10	147	30.7	16.5	119	0.91	109	14.3	10.8	154.5	0.770	105	72	+ 50	+ 46	−3.67
59,170	15	153	45.3	17.0	153	0.91	139	15.9	12.4	197.0	0.775	134	89	+ 57	+ 50	−3.60
72,285	13	141	30.0	14.0	100	0.92	92	12.8	10.2	131.0	0.760	89	70	+ 30	+ 27	−3.26

(*Table cont. on p. 368*)

TABLE I: CHILDREN'S HEARTS, NORMAL AND ABNORMAL (*Contd.*)

					Planimeter Method			Diameter Method								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
X-ray or Unit No.	Age (yr.)	Height (cm.)	Weight (kg.)	AP Chest Diameter (cm.)	Gross Area (sq. cm.)	Divergent Distortion Correction Factor	Net Area (sq. cm.)	Long Diameter (cm.)	Short Diameter (cm.)	L × S*	Agp/L × S†	Net Area (sq. cm.)	Predicted Area (sq. cm.)	Percentage Variation from Normal Planimeter Method	Percentage Variation from Normal Diameter Method	Percentage Variation of Diameter Method from Planimeter Method
50,941	9	128	24.5	17.0	73	0.91	66	10.8	9.2	99.0	0.740	68	62	+ 6	+ 10	+3.03
86,766	9	137	27.0	17.5	89	0.91	81	12.0	9.8	117.5	0.755	80	67	+ 21	+ 20	−1.23
89,086	13	128	22.6	16.0	87	0.91	79	12.3	9.9	122.0	0.710	83	60	+ 31	+ 39	+5.06
96,873	14	169	43.0	22.0	146	0.89	130	15.6	12.5	195.0	0.750	132	89	+ 46	+ 48	+1.54
U413,216	9	135	23.6	15.5	66	0.91	60	10.8	8.1	87.5	0.755	60	62	− 3	− 3	0
U431,282	7	125	24.5	15.5	61	0.91	55	10.0	8.3	83.0	0.735	56	64	− 13	− 12	+1.82
61,986	16	159	47.0	19.0	144	0.90	130	15.6	12.3	192.0	0.750	130	92	+ 41	+ 41	0
67,453	3	104	17.0	13.0	76	0.92	70	10.6	9.1	96.0	0.790	66	50	+ 40	+ 33	−5.72
67,838	7	117	21.0	14.5	61	0.92	56	9.0	8.3	74.5	0.815	51	57	− 2	− 10	−8.92
69,888	5	119	25.5	14.5	55	0.92	50	9.9	8.0	79.0	0.695	54	62	− 19	− 13	+8.00
73,927	7	122	22.0	14.0	96	0.92	88	13.0	9.6	125.0	0.750	85	59	+ 50	+ 45	−3.41
62,319	11	156	34.0	18.0	179	0.90	161	17.4	14.3	249.0	0.720	165	77	+108	+113	+2.48
39,961	13	147	36.2	16.0	99	0.91	90	13.3	9.9	132.0	0.750	90	78	+ 15	+ 15	0
37,529	11	161	48.8	19.0	156	0.90	140	16.2	13.5	219.0	0.710	149	94	+ 50	+ 58	+6.43
55,186	15	164	37.3	17.5	160	0.90	145	15.6	13.6	212.0	0.755	144	82	+ 76	+ 75	−0.69
55,913	12	150	37.3	17.0	117	0.91	106	14.1	11.6	163.0	0.720	111	80	+ 33	+ 40	+4.71
29,174	10	138	29.2	16.0	69	0.91	63	10.5	9.0	93.5	0.730	64	69	− 9	− 7	+1.59
33,056	6	123	26.0	14.0	67	0.92	62	10.6	8.3	88.0	0.760	60	63	− 2	− 5	−3.22
54,921	5	107	18.5	13.0	61	0.92	56	9.7	8.4	81.5	0.750	56	52	+ 9	+ 9	0
57,695	11	148	41.8	17.0	135	0.91	123	14.9	12.3	183.0	0.740	125	84	+ 46	+ 49	+1.63
25,194	8	120	21.7	15.5	61	0.91	56	10.6	8.0	85.0	0.720	58	58	− 4	0	+3.57
38,440	12	154	38.0	18.0	95	0.90	86	12.2	10.3	126.0	0.755	86	80	+ 8	+ 8	0
16,778	11	152	40.6	18.0	193	0.90	174	18.3	14.5	268.0	0.720	180	83	+109	+115	+3.44
47,603	7	123	20.9	18.0	120	0.90	108	13.6	12.3	167.0	0.720	114	58	+ 88	+ 97	+5.55
48,991	13	135	27.5	17.0	91	0.91	83	12.7	9.3	118.0	0.840	80	67	+ 24	+ 20	−3.62
39,535	11	134	24.4	16.5	195	0.91	177	17.2	14.7	253.0	0.770	172	63	+178	+172	−2.82
33,515	7	135	24.7	16.0	70	0.91	64	10.8	8.8	95.0	0.740	65	64	0	+ 2	+1.56
16,466	7	132	28.1	15.5	67	0.91	61	10.1	9.1	92.0	0.730	63	67	− 9	− 5	+3.28
34,389	6	112	22.0	14.0	65	0.92	60	10.4	8.3	86.0	0.755	58	57	+ 5	+ 2	−3.34
35,338	8	131	28.3	14.5	59	0.92	54	9.3	8.7	81.0	0.740	55	67	− 19	− 17	+1.85

33,515	7	135	24.7	16.0	70	0.91	64	10.8	8.8	95.0	0.740	65	64	0	+ 2	+1.56
16,466	7	132	28.1	15.5	67	0.91	61	10.1	9.1	92.0	0.730	63	67	+ 9	+ 5	+3.28
34,389	6	112	22.0	14.0	65	0.92	60	10.4	8.3	86.0	0.755	58	57	+ 5	+ 2	+3.34
35,338	8	131	28.3	14.5	59	0.92	54	9.3	8.7	81.0	0.740	55	67	+ 19	+ 17	+1.85

TABLE I: CHILDREN'S HEARTS, NORMAL AND ABNORMAL (*Contd.*)

					Planimeter Method			Diameter Method								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
X-ray or Unit No.	Age (yr.)	Height (cm.)	Weight (kg.)	AP Chest Diameter (cm.)	Gross Area (sq. cm.)	Divergent Distortion Correction Factor	Net Area (sq. cm.)	Long Diameter (cm.)	Short Diameter (cm.)	L × S*	Agp/L × S†	Net Area (sq. cm.)	Predicted Area (sq. cm.)	Percentage Variation from Normal Planimeter Method	Percentage Variation from Normal Diameter Method	Percentage Variation of Diameter Method from Planimeter Method
35,525	9	137	31.6	16.0	85	0.91	77	11.9	9.6	114.0	0.745	78	71	+ 8	+ 10	+1.30
36,684	12	146	37.0	16.5	82	0.91	75	11.4	9.6	109.0	0.750	75	79	− 5	− 5	0
36,811	6	112	17.0	15.0	54	0.91	50	9.7	7.4	72.5	0.745	49	52	− 4	− 5	−2.00
116,011	14	147	27.7	20.0	189	0.90	173	18.5	14.8	274.0	0.690	185	70	+146	+163	+6.95
116,080	12	148	37.0	16.0	131	0.91	120	15.8	11.9	188.0	0.695	128	79	+ 54	+ 62	+6.65
95,036	12	145	29.7	17.5	135	0.90	123	13.6	13.0	177.0	0.760	120	71	+ 73	+ 69	−2.44
89,086	13	128	22.6	16.0	87	0.91	79	12.2	10.0	122.0	0.710	83	60	+ 32	+ 40	+5.05
U412,517	3	97	13.2	12.0	44	0.92	39	8.8	6.8	60.0	0.735	41	45	− 12	− 8	+5.13
U431,255	4	107	18.0	13.5	46	0.92	42	8.4	7.3	61.0	0.750	42	52	− 19	− 19	0
U426,958	7	112	26.0	15.5	64	0.91	58	10.2	8.5	87.0	0.735	59	61	− 5	− 3	+1.72

Explanation of Table I

One hundred children's chest films with a wide range of heart sizes, ages varying from three to sixteen years, were selected at random. All hearts were measured independently by two methods: (1) a planimeter tracing of the complete cardiac silhouette; (2) the long and short diameter method employing the nomogram.

When the planimeter method was used, the divergent distortion correction factor was figured individually for each patient. The average divergent distortion correction factor (0.91) used in construction of the nomogram was obtained by totaling these and dividing by 100.

The factor which, when multiplied by the product of the long and short diameter, would yield frontal plane area was obtained from the formula Agp/L × S.† The average factor (0.75) was obtained by adding the correction factors calculated for each case and dividing by 100.

The percentage variation of diameter method from planimeter method (column 17) was derived by subtracting the net frontal plane area obtained by planimeter measurement (column 8) from the net frontal p ane area obtained by the long and short diameters (column 13). The remainder was divided by the values in column 8 to yield the percentage variation of diameter method from planimeter method. From the table, we see that the maximum variation between the two methods was less than ± 10 per cent.

* Long diameter (in cm.) multiplied by short diameter (in cm.).

† Gross cardiac area measured by planimeter divided by the product of the long and short diameters.

years. However, if the stature exceeds 170 cm., the adult nomogram would apply regardless of the age.

(2) The chest film must be taken upright with the anterior surface of the chest closest to the film at a target-film distance of 72 inches.

SUMMARY

1. For the measurement of children's hearts by the long and short diameter method, the following equation is offered:

$$A = L \times S \times 0.68$$

where

A = frontal plane area of the cardiac silhouette
L = long diameter in cm.
S = short diameter in cm.

2. A nomogram using this equation is provided, reading directly in percentage variation from normal.

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Salt Lake City, Utah.

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2. HODGES, P. C., ADAMS, W., AND GORDON, W.: Estimation of Cardiac Area in Children. J.A.M.A. **101:** 914–916, Sept. 16, 1933.

SUMARIO

Método para Medir los Corazones de los Niños

Para medir los corazones de los niños con la técnica de los diámetros largo y corto, ofrécese la siguiente ecuación:

$$A = L \times C \times 0.68$$

en la que

A = el área plana frontal de la silueta cardíaca
L = el diámetro largo en cm.
C = el diámetro corto en cm.

Suminístrase un nomograma que utiliza esta ecuación, y permite apreciar directamente las variaciones porcentarias de lo normal.

The Diagnosis of Intra-Auricular Thrombosis in the Living[1]

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IN CHRONIC DISEASE of the heart, prognosis and therapy depend not only upon the anatomical and etiological diagnosis of the damage but also on the proper assessment of the repair, the work demanded of the damaged organ, and the reserve left to deal with the load thrown upon the defective mechanism. Even the most careful calculations, however, may be overthrown by unforeseen accidents, and the outlook may suddenly be completely changed. Among such accidents is the occurrence of thrombi within the chambers of the heart, with consequent interference with the peripheral circulation and embolism.

The frequent occurrence of thrombi within the ventricles and auricles, particularly in mitral stenosis, is proved by numerous autopsy reports. Among 178 rheumatic hearts examined by Graef *et al.*, 24 showed mural thrombi, which in 14 cases were lodged in the left auricle, in 5 in the right, and in 5 in both auricles. Among 60 patients with auricular fibrillation and rheumatic heart disease, Garvin found 26 cases of mural thrombosis at autopsy (43.3 per cent). In a series of 771 patients with all types of heart disease, including coronary artery disease, hypertensive heart disease, and syphilitic heart lesions, the incidence was 34.4 per cent.

In sharp contrast to their frequency in autopsy series is the small number of intra-auricular thrombi diagnosed during life. Few have been recognized clinically, and still fewer roentgenographically. These thrombi are not an agonal or postmortem phenomenon; they are not the terminal outcome of auricular fibrillation; they are, according to Levine, an important cause of an appreciable number of deaths (20 per cent), and they might well be amenable to modern anticoagulant treatment. That there is sufficient time for the application of such treatment if the diagnosis is made early is evident from a report by Schwartz and Biloon in which signs of embolism occurred in 1919 and death ensued seven years later (1926) from proved auricular thrombosis. Similarly one of our own patients who now shows roentgenologic evidence of auricular thrombosis and electrocardiographic evidence of auricular fibrillation had the first signs of cerebral embolism, leading to temporary hemiplegia, in 1931 and signs of pulmonary infarction in 1946.

Auricular thrombi are of two kinds, the non-occluding and the occluding. The non-occluding thrombi are those which do not impinge on the auriculo-ventricular orifice and therefore do not impede the flow of blood from auricle to ventricle. By far the great majority of auricular thrombi are of this type. The occluding thrombi are those which, because of their size and position, impinge on the valve orifice and hinder the flow of blood through it. They may be pedunculated or completely free as loose bodies in the auricular cavity. The spherical free clots are the so-called ball thrombi.

CLINICAL DIAGNOSIS

The diagnosis of thrombosis of the left auricle can be suspected clinically in rheumatic heart disease with mitral stenosis (or in heart failure), particularly if associated with auricular fibrillation, on the basis of embolization to the peripheral arteries. The clinical diagnosis of an occluding thrombus of the left auricle was first made by Ziemsen (1890) in 3 cases on the evidence of circumscribed gangrene of the feet, coldness and swelling of the

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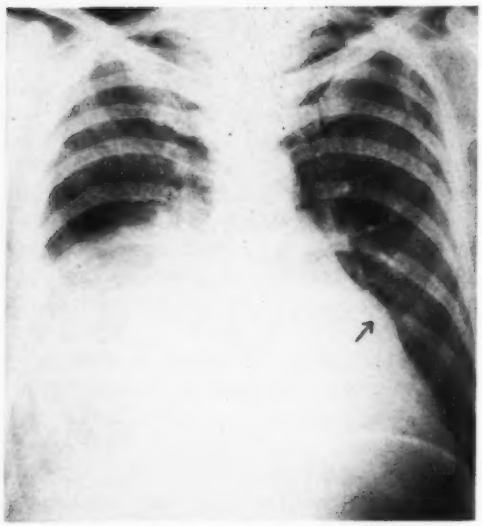

Fig. 1. Case I: J. K., 66-year-old male. Elevation of the left heart border due to widened left auricular appendage. *Autopsy findings:* Mitral stenosis and regurgitation; large mural thrombus in the left auricle; dilatation of the left auricle; pulmonary infarct and pneumonia.

lower extremities, and absence of pulsation in the large arteries of the leg. Bozzolo and Battistini were also able to make a diagnosis of occluding left auricular thrombosis on evidence of disturbance of peripheral circulation in patients with mitral stenosis. In one case the feet were markedly cyanotic, there was a necrotic area on the outer lower aspect of the tibia, and the left leg was numb, cold, and painful. In other cases (Battistini) there was either cyanotic discoloration of both legs, coldness, numbness, or gangrene. In Lutembacher's case, in which a ball thrombus was found at autopsy combined with mitral stenosis and subacute bacterial endocarditis, necrotic spots appeared on the face and forearm, and the nose became discolored and black.

The clinical diagnosis of a non-occluding thrombus of the right auricle is a presumptive one, based on embolization of the lungs in the presence of cardiac failure, particularly if associated with auricular fibrillation. The presumption is strengthened if there is no evidence of thrombosis of the veins of the legs or pelvis.

The clinical diagnosis of an occluding thrombus of the right auricle had until recently never been made except at autopsy. In 1944, Wright and his co-workers, reporting a case in which the presence of a ball thrombus in the right auricle was suspected during life, attempted to formulate a characteristic syndrome. We have ourselves followed a case to autopsy in which a unique clinical finding, observed before the terminal picture developed, was the occurrence of cyanosis of the face, neck, upper chest, hands and fingers when the patient was in the recumbent posture and its disappearance in the sitting position. This apparently was due to some mobility of the thrombus, which shifted toward the mouth of the superior vena cava in the auricle in recumbent position, so that it partially occluded the vein and impeded the free flow of blood into the auricle. In the sitting position the thrombus by its weight shifted away from the mouth of the vein, permitting it to empty freely. It thus appears that a large intra-luminal clot in the right auricle may in rare instances disclose itself clinically not only by signs of occlusion of the tricuspid orifice, but also by those of intermittent occlusion of one of the great veins in the manner described.

ROENTGENOGRAPHIC ASPECTS

Thrombi within the chambers of the heart can be recognized roentgenologically either by their density or by changes in the cardiac contour. When of sufficient size, and particularly when impregnated with calcium, they can be identified as round compact shadows in the right or left auricle. Such calcified intra-auricular thrombi were observed by Scholz, Besser, Schwedel, and Heeren. Non-calcified soft mural thrombi are more difficult of demonstration. Undue prominence of the appendage of the left auricle over an otherwise flat left cardiac outline was first described by Arendt in 1930, as suggestive of thrombus formation. At autopsy, in his case, the prominent segment was found to be filled with soft thrombotic material. Fortified by this earlier experience and stimu-

lated by the development of cardiac surgery and more efficient anticoagulants, we have again turned our attention to the problem of the diagnosis of such soft intramural thrombi in the living man.

The literature accumulated in the interim consists of two reports, one by Berk and one by Füssl. Füssl's case is of particular interest, as it showed such a marked prominence of the third left heart segment, beneath the pulmonary artery, that a malignant neoplasm of the mediastinum was diagnosed. At operation no tumor was found. Autopsy revealed left-sided enlargement of the left auricle due to mural thrombi. This report not only demonstrates the significance of the roentgen findings, but it also presents one of several differential diagnostic possibilities.

The problem is further illustrated by a case which recently came under our observation (Case I). A 66-year-old male with clinical evidence of mitral stenosis and auricular fibrillation presented the roentgenologic picture seen in Figure 1. The heart shadow was generally enlarged, with particular enlargement of the right heart. Along the flattened left border was a persistent elevation which we attributed to the appendage of the left auricle, which was prominent and showed diminished pulsation due to the presence of intra-auricular mural thrombi. At autopsy (Dr. I. Davidsohn), the mitral stenosis was confirmed, and the left atrium proved to be tremendously dilated. A large mural thrombus was found, measuring 4.0 × 2.0 cm., adherent to the medial wall and rising from it about 1.0 cm.

A second patient, a male 46 years of age, came to us with the tentative diagnosis of renal colic (Case II). The flat film and the intravenous pyelogram gave no evidence of a gross kidney lesion. Normal diodrast clearance of both kidneys was noted. A postero-anterior film of the chest (Fig. 2), revealed enlargement of the right and left heart, and again a particular prominence of the third left arch just above the upper demarcation point of the left ventricle. On roentgen evidence, we diagnosed a rheumatic heart, a combined mitral and aortic lesion, and postulated the presence of auricular fibrillation and thrombus formation, in view of the prominence of the left auricular appendage. We suggested that the pain in the right flank might be due to infarction. The presence of auricular fibrillation was proved immediately by an electrocardiogram. The patient left the hospital and died one month later in another hospital. The autopsy report (Dr. A. C. Twiss) reads, in abstract: "Chronic fibrous and verrucous endocarditis (rheumatic) of the aortic (stenosis) and of the mitral valve. Huge mural thrombus of the lining of the left auricle and auricular appendage of the heart. Recent infarcts in spleen and kidney, and focal ulceration of the posterior leaflet of the mitral valve."

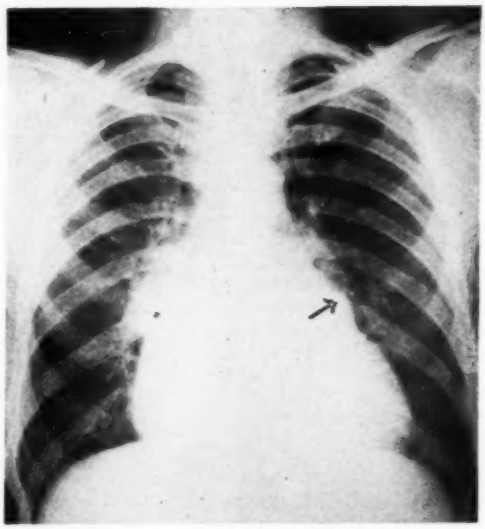

Fig. 2. Case II: W. B., male aged 46. Enlargement of the right and left heart. Prominence of the third left arch, suggesting appendage dilatation of the left auricle and thrombus (non-calcified) within the left auricle. *Autopsy findings:* Chronic rheumatic endocarditis; aortic and mitral stenosis; huge mural thrombus filling the left auricle and its appendage.

A similar roentgen picture of a prominent auricular segment along the left heart border is seen in Figure 3 (Case III). This patient was a 58-year-old male with the first signs of cerebral embolization twelve years earlier. The left border of the dilated heart shows

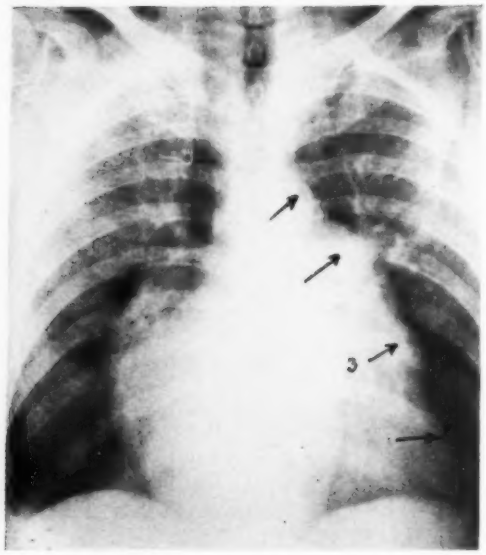

Fig. 3. Case III: J. S., 58-year-old male. The left heart border shows four well defined subdivisions. The third arch is due to dilatation of the left auricular appendage. A streak of calcium is visible. The esophagus is displaced to the left. *Clinical diagnosis:* Chronic auricular fibrillation. First cerebral embolization twelve years earlier.

four distinct subdivisions clearly demarcated in spite of the marked general enlargement. These are, in order, (1) the aortic arch; (2) the pulmonary trunk and artery; (3) the left auricular appendage; (4) the left ventricle. The elevation of the appendage of the left auricle suggested auricular fibrillation and thrombus formation. Though no autopsy was available, auricular fibrillation was confirmed by the electrocardiogram, and the history supported our impression of thrombosis.

Our fourth case (Fig. 4) is that of a 53-year-old female with a history of rheumatic heart disease and clinical evidence of mitral stenosis. The roentgenogram shows the well-defined subdivisions of the left heart border, and the exaggerated prominence of the third left arch representing the appendage of the left auricle. Auricular fibrillation and thrombus formation were suggested by the x-ray appearance. Auricular fibrillation was confirmed electrocardiographically. An infarct is visible in the left lower lung.

These new cases, added to the few previously reported in the literature, strengthen our opinion that the exaggerated prominence of the third left arch of the heart outline represents the enlarged appendage of the left auricle, and that this is particularly prominent in cases where auricular fibrillation is combined with left auricular mural thrombosis. The prominence of the appendage remains elevated in such cases even when the left heart contour is otherwise sagging and flat.

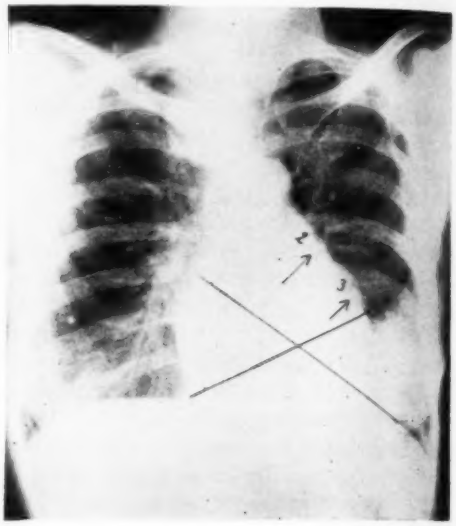

Fig. 4. Case IV: E. S., 53-year-old female. Well defined characteristic subdivisions of the left heart border with the appendage elevation unusually prominent. *Clinical diagnosis:* Auricular fibrillation with mitral stenosis; infarct in the left lung base.

At the time of our first observation of such an elevated third segment along the left cardiac border, the opinion of roentgenologists and pathologists as to the location of the appendage of the left auricle in mitral stenotic hearts was divided; there were numerous investigators who called the segment above the left ventricle the "conus segment" and attributed it to an enlargement of the outflow tract of the right ventricle and elevation of its conus portion. Many of our modern textbooks still favor this opinion. Among earlier observers, we find better agreement as to the participation of the left auricle in

the formation of this middle segment. While Groedel attributed the elevation to the left auricle proper, Assmann held that it is only the appendage of the left auricle, closely attached to the pulmonary conus, which becomes marginal in the posterior anterior view of a mitral stenotic heart. The position taken by Roesler is that it is *either* the conus portion of the right ventricle *or* the enlarged left auricular appendage which forms the prominence between the pulmonary artery and the left ventricle, and that sometimes both structures may participate.

Since the observations cited above are based on autopsy findings, it seemed imperative to clear this fundamental question by physiological methods applicable to the living. Kymography demonstrates a type of wave in the area of the middle segment which is distinctly different from the ventricular wave. The waves are smaller and more frequent, but they are mixed curves. Unless electrokymography is able to simplify them and permit a clearer analysis, they are less suitable for demarcation and identification of the subdivisions than a simple fluoroscopic study.

Of greatest interest and probably of decisive value is angiocardiography, as it permits consecutive filling and observation of the various chambers of the heart. Sussman obtained angiocardiographic pictures in which the appendage of the left auricle was clearly shown as forming a substantial segment of the left middle heart outline. According to him, the conus portion of the right ventricle is far away from the left heart border and does not form any part in its contour in the anterior projection. The angiocardiographic findings thus strengthen our own opinion as to the participation of the dilated appendage in the formation of the left middle segment. Yet, it should be conceded, and the increasing application of angiocardiography to all types of cardiac disease will no doubt prove, that the marked enlargement of the right heart in late stages of mitral stenosis and mitral insufficiency leads frequently to a counterclockwise rotation of the heart.

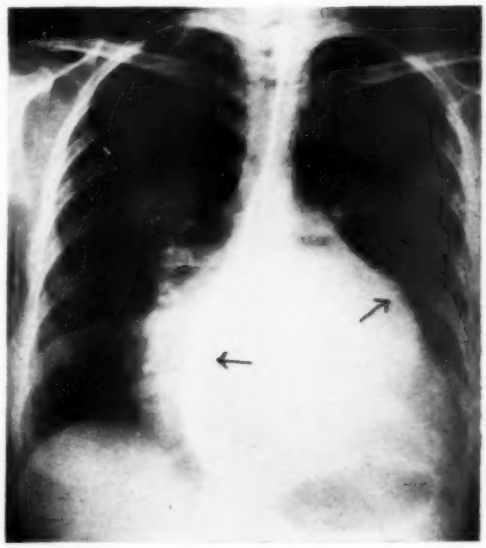

Fig. 5. Case V: E. B., 36-year-old female. *Clinical diagnosis:* Mitral stenosis and auricular fibrillation. X-ray film on March 9, 1948, shows semicircular left-sided dilatation of the left auricle. Prominence of left heart border formed by huge left auricle.

This in turn brings the right ventricle and its conus into greater prominence and obscures the left auricular appendage by displacing it backward. In such cases the place of the appendage segment along the left heart border is taken over by the right ventricle and the pulmonary conus, and the resulting x-ray picture is that of a shallow convexity extending from the aortic to the ventricular prominence. In auricular septal defect, Lutembacher's disease, and in cor pulmonale, it is the right ventricle which forms the prominent middle segment and rarely, if ever, is the auricular appendage apparent in the postero-anterior view.

Another variation whereby not only the appendage but also the left auricle itself becomes marginal along the left heart border is illustrated in Figure 5 (Case V). The segmental left-sided elevation is part of a globular shadow which extends far over the midline and displaces the esophagus to the right. Fluoroscopic examination in this case led to identification of the dense shadow as the left auricle. Electrocardiographic findings were those of auricular

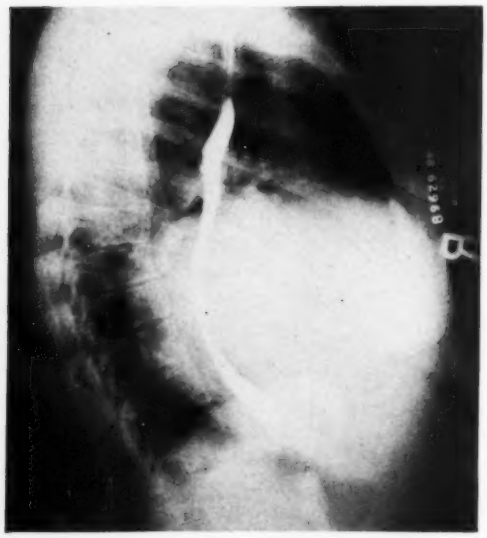

Fig. 6. Case V: Right oblique view showing the eccentric position of the esophagus along the right lateral wall of the dilated left auricle. In spite of maximal auricular dilatation, there is only moderate backward displacement of the esophagus (see text).

fibrillation. An infarct is seen in the right lung.

Enlargement of the left auricle occurs first in its thin-walled portion, while the appendage, with its stronger spongy musculature, resists such dilatation for a longer time. The common picture of the mitral stenotic heart is, therefore, enlargement of the left auricle backward, usually followed after a brief interval by enlargement to the right. During this time, the esophagus is in close contact with the auricle and is therefore also displaced backward and to the right. The dilatation may continue in the same direction, reaching as far as the right heart border, assuming aneurysmal proportions. In certain cases, however, two deviations from this regular sequence have been observed. (1) The direction of the auricular enlargement is mainly or entirely to the *left*. (2) The esophagus as seen in the frontal view is displaced not to the right but to the left.

These phenomena, in the absence of deformities of thorax and spine, indicate a modified eccentric enlargement of the left auricle. The dilated auricle behaves like an aneurysm, and the direction of its spread is dictated by the proportion of pressure and resistance (as can be demonstrated by pressure upon a filled water bag); its normally concentric contraction is changed into an inefficient, unregulated contraction which drives the blood mass in the direction of the least resistance, more frequently to the right, though sometimes to the left side. As the dilatation progresses, the esophagus may either remain in contact with the summit of the bulging cone or may slip over to one or the other side, as has been demonstrated by Evans. Figure 6 (Case V) illustrates such a slip of the esophagus to the lateral wall of the auricle, leading to marked lateral and minimal posterior displacement. It is our opinion that such a sliding of the esophagus over the summit of the auricular cone can easily occur, as the dilatation of the auricle is not unidirectional but variable and frequently eccentric.

When the enlargement of the left auricle is predominantly to the left, it is either part of a general dilatation which has finally extended over the trabeculated part of the auricle, or it is a localized dilatation of this part due to an endocarditis affecting first and foremost the tip of the auricle and the auricular appendage. The French authors, Heim de Balsac and Routier, in their injection studies of the left auricle, noted both types of left auricular dilatation. We find a similar picture of predominantly left-sided auricular enlargement characterized as "unusual" in Roesler's well known textbook. Here we have a special problem before us which deserves further investigation. Pathological and anatomical data available at present are insufficient to explain fully the mechanism and the variations of the auricular dilatation. More important for the roentgenologist is the awareness that a *variable sector* of the left heart border is taken up not by the pulmonary artery and pulmonary cone, but by the left auricle and its appendage. Our observations have shown that this occurs particularly in the presence of mural thrombosis accompanied by auricular fibrillation.

In rheumatic endocarditis with mitral stenosis and auricular fibrillation, mural thrombosis tends to occur first in the auricular appendage since, once auricular dilatation and paralysis occur, the heavy inner trabeculation of the pectinate network acts as a mesh upon which the static blood deposits thrombi. These thrombi grow by apposition, but remain friable. They degenerate, with fat and cholesterin deposits; they may calcify and may produce emboli.

The anatomical situation is somewhat different in the right auricle. This auricle has the great veins as "safety valves" and is, therefore, less capable of the extreme enlargement of the left. Aneurysmal massive dilatation of the left auricle (with a wall thickness of 1.0 mm.) and erosion of the spine have been observed in a rheumatic heart; not, however, of the right auricle. In contrast to the left auricle, it is the trabeculated area which dilates first in the right auricle (Schwedel); the smooth-walled body follows later. No characteristic deformity has yet been observed. The task of identifying thrombi, if not calcified, has been too much for our present methods.

There remains the explanation of a rather puzzling problem. In two to three instances we found a particularly prominent left auricular appendage in apparently normal persons. Roesler reports that "excessive enlargement of the left auricular appendage of unknown etiology is a very rare condition." The answer, we believe, is given by Levine in a discussion of Garvin's paper, in which he states that auricular thrombosis supervened in a patient of his with a normal heart but with auricular fibrillation. Therefore, whenever the roentgenologist reports a particularly marked prominence of the auricular appendage, even in an apparently healthy person, the possibility of auricular fibrillation and thrombus formation should be considered.

CONCLUSIONS

Not only calcified thrombi but also soft mural thrombi can, under certain conditions, be recognized in standard x-ray pictures of the heart. Undue prominence of the left auricular appendage is frequently due to thrombus formation in the left auricle. It is a sign that the appendage area participates in the dilatation of the auricle and is frequently accompanied by auricular fibrillation.

An intermittent postural superior vena cava syndrome is described as a sign of possible value in the diagnosis of mural thrombosis in the *right* auricle.

NOTE: In the *Bulletin* of the American College of Surgeons for January 1949, the first two operations on the left auricular appendage as a prophylactic measure for recurrent emboli are reported. The operations were performed by Dr. John L. Madden, of the Long Island College of Medicine.

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SUMARIO

Diagnóstico de la Trombosis Intraauricular en el Vivo

En las radiografías corrientes del corazón, pueden reconocerse, no tan sólo trombos calcificados, sino también, en ciertas condiciones, trombos parietales blandos. La exagerada prominencia del apéndice auricular izquierdo se debe frecuentemente a formación de trombos en la aurícula, constituyendo un signo de que la zona apendicular participa en la dilatación de la aurícula y yendo frecuentemente acompañada de fibrilación auricular.

Como signo de posible valor en el diagnóstico de la trombosis parietal de la aurícula derecha, descríbese un síndrome postural intermitente de la vena cava superior.

Pulmonary Metastases of Pseudo-Adenomatous Basal-Cell Carcinoma (Mucous and Salivary Gland Tumor)

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MUCOUS AND salivary gland neoplasms comprise a diverse group in respect to sites of origin, clinical evolution, histologic pattern, and degree of malignancy. In the literature, one of these tumors bears a multiplicity of names: basal-cell carcinoma with cylindromatous transformation, basaloma, cylindroma, adenoid cystic epithelioma, adenocarcinoma, pseudo-adenomatous basal-cell carcinoma, and others. At the University Hospital (University of Michigan) this tumor, whose most prominent feature consists of tubular or cord structures made up of cuboidal epithelial cells identical with the cells of basal-cell carcinoma, is designated as pseudoadenomatous basal-cell carcinoma.

In Ahlbom's monograph, (1) most of the neoplasms of this histologic type are classed as semi-malignant or malignant. Local invasion, regional lymph-node metastases, and remote metastases (chiefly pulmonary) have been reported. Both the primary tumor and the metastases have been described by Ahlbom as having "a sedate course" clinically. This observation regarding the metastases appears, however, to be based on the evolution of those in the regional lymph nodes. Little information is available on the clinical course of pulmonary metastases except for a single case reported by one of the present authors in 1942 (2). Since then, additional patients with pulmonary metastases have been seen and followed. These cases present an essentially uniform clinical pattern which merits emphasis from the point of view of the natural history of the neoplasm. Lack of knowledge in this respect may lead to error in the management of the disease.

Review of the records at the University Hospital, from 1930 to date, disclosed 25 cases of pseudo-adenomatous basal-cell carcinoma. The sites of origin were as follows: palate 3, parotid 3, lacrimal gland 2, submaxillary salivary gland 1, paranasal sinuses 6, nasopharynx 3, oral part of the tongue 4, pharyngeal portion of the tongue 1, elsewhere in the oral cavity 2. Pulmonary metastases were discovered by roentgenographic examination in 5 (20 per cent) of the patients.

As a result of the confusion which has existed in the classification of this tumor, particularly in the earlier years, cases may have been lost. Indeed, 22 of the 25 cases have been diagnosed since 1936. Because of this, one may argue that 20 per cent is too high an incidence figure. On the other hand, 7 patients did not have chest roentgenograms, so that pulmonary metastases may have been overlooked (as will become apparent from the discussion to follow). Furthermore, in the remaining 13 with negative chest roentgenograms, the examinations covered a period of five years in one patient, two and three-quarter years in one, eleven months in another, six and two months, respectively, in 2 more. In 8 patients, only a single examination was done. In 6 of the 8, the interval between onset of the disease and roentgenography was two years or less. With a neoplasm which may pursue a course protracted over years, such early and incomplete roentgenographic recording of the appearance of the lungs would not disclose the true incidence of pulmonary metastases. It appears probable that metastases in the lungs occur relatively frequently. This is in accord with the statement by Ackerman and del Regato (3) that this "type is par-

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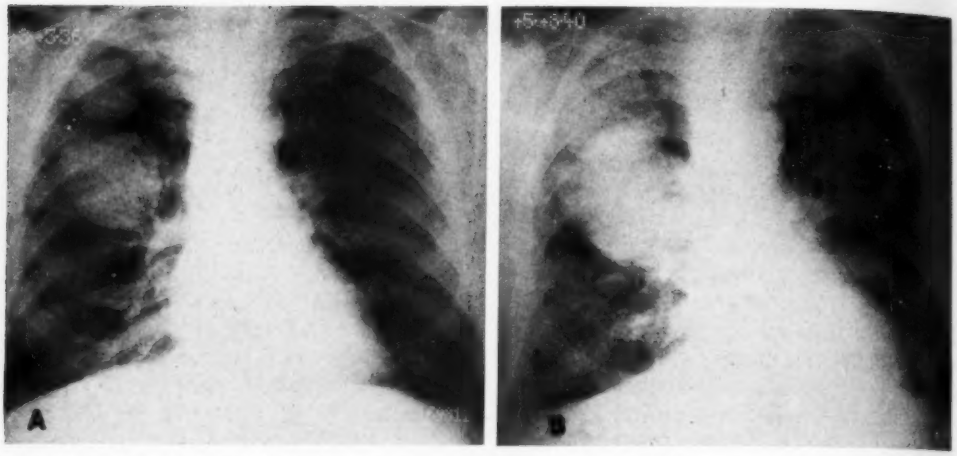

Fig. 1. Case I. A. Aug. 3, 1936. Pulmonary metastases from pseudo-adenomatous basal-cell carcinoma of the pharyngeal part of the tongue, discovered nine years after the first admission. No pulmonary symptoms. B. May 8, 1940. This roentgenogram was made three years and nine months after A. The metastases have increased in size and number but are still asymptomatic.

ticularly prone to give pulmonary metastases."

Abstracts of the case histories of the 5 patients with known pulmonary metastases are presented:

CASE 1:[2] G. W., a white male, age 57, was first seen June 2, 1927, with a mass in the pharyngeal part of the tongue. Treatment with small doses of radium (surface application and interstitial radon seeds) was without effect. On April 11, 1929, the lesion was destroyed by electrocoagulation. Seven years later, Aug. 3, 1936, the patient was admitted with a large recurrent mass in the base of the tongue, with bilateral cervical metastases (5 cm. in diameter); dysphagia was present. Chest roentgenograms (Aug. 3, 1936) showed large pulmonary metastases (Fig. 1A). Roentgen therapy was given through right and left neck fields (6 × 8 cm.), cross-firing the primary tumor (200 kv., h.v.l. 0.9 mm. copper, 50 cm. distance). Treatment extended from Aug. 10 to Sept. 9, reaching a total of 2,600 r (in air) per field. Progressive decrease in the size of the neoplastic foci followed.

On Feb. 16, 1938, the patient was asymptomatic, the lingual lesion was one-half its original size, and no cervical metastases were detectable. Chest films at this time showed some increase in the pulmonary involvement; 900 r was given to each of four chest fields, at the rate of 300 r per day to one field, without significant effect.

On May 6, 1940, the patient was re-admitted with pain in the right leg, of three months duration, but no symptoms referable to the throat or lungs. Examination showed extension of the primary lesion into the floor of the mouth. Roentgenograms showed a metastasis in the upper part of the right femur, and the chest films (three and three-quarter years after the first chest examination) showed increase in number and size of the pulmonary lesions (Fig. 1B). The osseous metastasis was treated to diminish the pain (600 r to each of three fields, 15 × 15 cm., in three days).

The patient reported by letter, on Sept. 30, 1940, that his pain had disappeared. He died on May 8, 1941.

Pathological Diagnosis: Pseudo-adenomatous basal-cell carcinoma.

Comment: Pulmonary metastases are known to have been present in this patient since 1936, four and three-quarter years prior to death. At no time were pulmonary symptoms present. The large size of the metastatic lesions at the time of their initial discovery and the slow rate of growth during the subsequent course suggest they had been in existence for several years prior to 1936. Fourteen years elapsed between the patient's first admission and his death; it is probable that pulmonary metastases were present for almost half of this period.

CASE 2: M. G., a white female, age 33, had a left parotid tumor in 1935. The first excision was performed in 1937. Recurrences were excised in 1939 and 1943. The patient was admitted to the University Hospital for the first time on Jan. 10, 1945, with an extensive recurrence in the left parotid

[2] Previously reported, July 1942 (2).

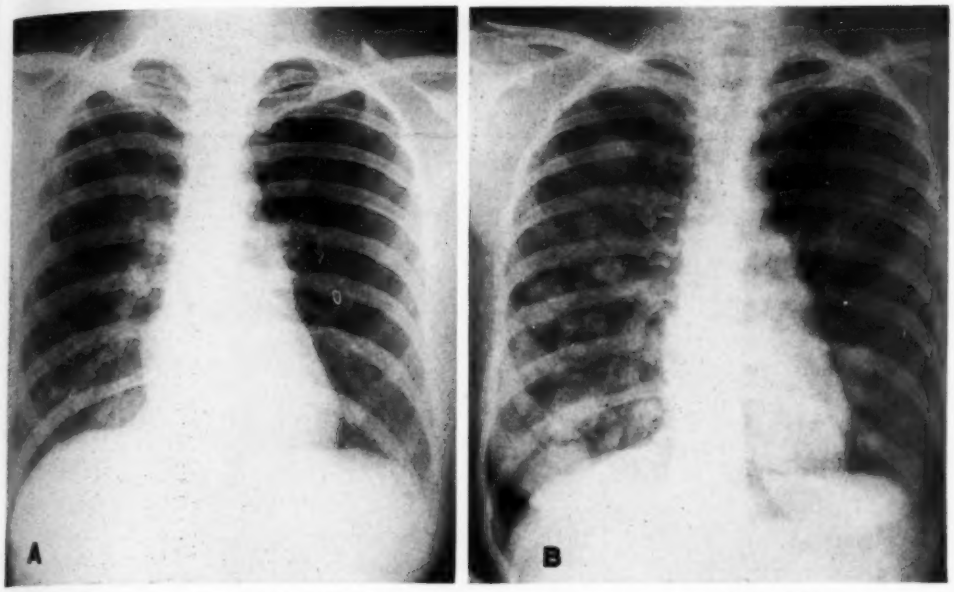

Fig 2. Case 2. A. Jan. 10, 1945. Two small pulmonary metastases are present in the right lung. One is projected on the lower margin of the anterior part of the right sixth rib; the other is projected onto the anterior part of the right second rib. This roentgenogram was made ten years after the appearance of a pseudo-adenomatous basal-cell carcinoma in the left parotid gland. No pulmonary symptoms.
B. Jan. 22, 1948. This roentgenogram, made three years after A, shows many pulmonary metastases but no pulmonary symptoms were present.

region; this was excised radically on Jan. 16, 1945. Chest films of Jan. 10, 1945 (Fig. 2A) showed two small metastases in the right lung; there were no pulmonary symptoms.

The patient returned on Jan. 19, 1948, with recurrence in the left parotid area and with preauricular and left cervical lymph-node metastases. Two fields, an upper and a lower, each 9 × 7 cm., were used to include the entire region of involvement. A dose in air of 3,500 r was given to each of the two fields from Jan. 26 to Feb. 17 (the same physical factors as in Case 1). The masses were considerably reduced in size by the time irradiation was completed; the patient has not yet returned for post-treatment examination. Chest films of Jan. 22, 1948, three years after the initial examination, showed many bilateral pulmonary metastases (Fig. 2B); no pulmonary symptoms were present.

Pathological Diagnosis: Pseudo-adenomatous basal-cell carcinoma.

Comment: In this patient, asymptomatic pulmonary metastases are known to have existed for three years. The neoplasm has been present for thirteen years, but the patient remains in a relatively fair state of health. The pulmonary lesions appeared approximately ten years after the onset of the disease.

CASE 3: A. G., a white female, age 63, was admitted to the University Hospital on Feb. 19, 1948, with a history of multiple excisions of a tumor involving the right superior maxillary region. As far as could be determined, the first operation had been done at least fifteen years before; the last excision of a recurrence was performed in the latter part of 1947. Examination showed subcutaneous neoplastic infiltration in the right maxillary region adjacent to the nose, extension throughout the right infra-orbital region and upper part of the cheek, and invasion of the right temporal fossa. Roentgenograms of the facial bones showed clouding of the right antrum and destruction of the zygoma. The chief complaint was pain in the right side of the face.

Between Feb. 10 and March 19, 1948, a dose of 3,200 r (in air) was delivered to a 10 × 6-cm. right lateral field and 3,000 r to a 6 × 6-cm. right anterior maxillary field (physical factors as described elsewhere). One month later the patient was free of pain and partial reduction of the neoplastic infiltration was demonstrable.

Pathological Diagnosis: Pseudo-adenomatous basal-cell carcinoma.

Chest films of Feb. 9, 1948 (Fig. 3B) showed numerous metastases in each lung, though no pulmonary symptoms were present at this time and the general condition of the patient was good. In September 1940, a subtotal thyroidectomy was done

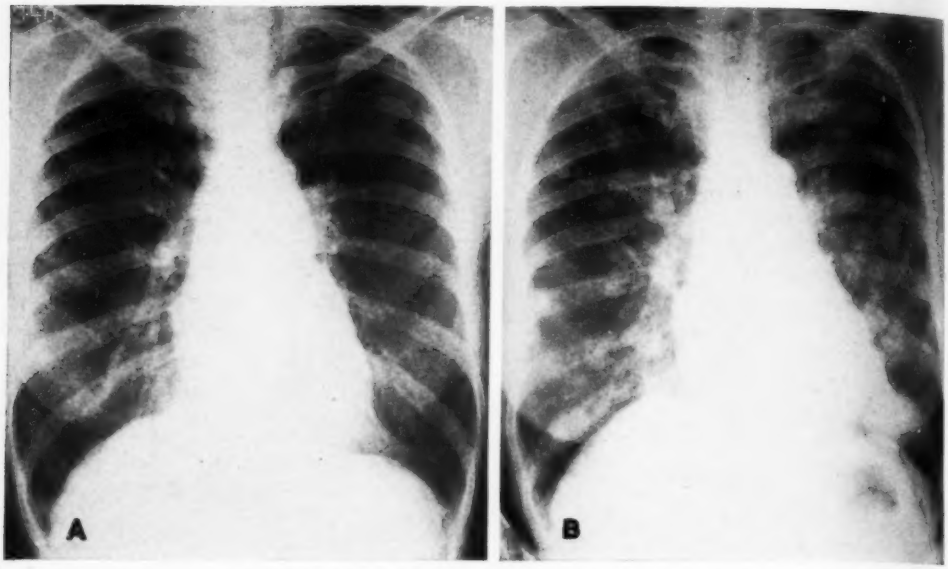

Fig. 3. Case 3. A. Sept. 23, 1940. This roentgenogram was made at least seven years after the first excision of a pseudo-adenomatous basal-cell carcinoma of the right upper maxillary region. Two small metastases are present: one in the right costophrenic sulcus, the other is projected onto the anterior part of the left seventh rib. No pulmonary symptoms.

B. Feb. 9, 1948. This roentgenogram was made seven years and four months after A. Many metastases are present but the patient did not have pulmonary symptoms. The largest metastases are at the sites of the lesions noted in A.

at the University Hospital because of thyrotoxicosis associated with an adenomatous thyroid. A routine chest film (Fig. 3A) made preoperatively (Sept. 23, 1940) was reported as negative for pulmonary disease, but review of the film showed a small metastasis in the lower left lung field and another in the right costophrenic sulcus. In the 1948 films, the largest of the many pulmonary lesions are found at these two sites. The interval between the two chest examinations was approximately seven and a third years.

Comment: Pulmonary metastases are known to have been present in this patient for at least seven and a third years. Although the lesions now are numerous, the patient has no pulmonary symptoms and is in fair health. The disease has existed for at least fifteen years.

CASE 4: E. Y., a white female, age 36, was admitted to the University Hospital on Sept. 25, 1944, with a history of painful swelling of the left lacrimal gland for two weeks. On Oct. 2, 1944, the lacrimal gland tumor was removed. On Feb. 8, 1946, because of recurrence, an exenteration of the contents of the left orbit was done. On May 17, 1947, several small recurrent nodules were excised from the orbital rim. Multiple small recurrent nodules were found in January 1948, on the lateral orbital rim extending out on the temple. From Jan. 27 to Feb. 13, a single field (6 × 6 cm.) over the left orbit and adjacent temple received 4,300 r measured in air (same physical factors as in the previous cases); some regression was apparent during the course of irradiation. The patient has not yet returned for post-treatment examination.

Pathological Diagnosis: Pseudo-adenomatous basal-cell carcinoma.

Throughout the interval from the first admission on Sept. 25, 1944, to the last observation on Feb. 13, 1948, this patient had no pulmonary symptoms. The first x-ray examination of the chest, Sept. 25, 1944, which was a routine admission photofluorogram, was negative. Another photofluorogram made on Jan. 6, 1946, showed a pulmonary metastasis in the right lower lung field; questionable lesions were present elsewhere (this 35 mm. film was not satisfactory for reproduction). On May 17, 1947, chest films (Fig. 4A) showed multiple bilateral metastases which, by Jan. 12, 1948 (Fig. 4B), had increased in size and number. (See Addendum, p. 385.)

Comment: Asymptomatic pulmonary metastases have been present for two years, the lesions appearing sixteen months after the clinical onset of the tumor. The duration of the disease, so far, is almost three

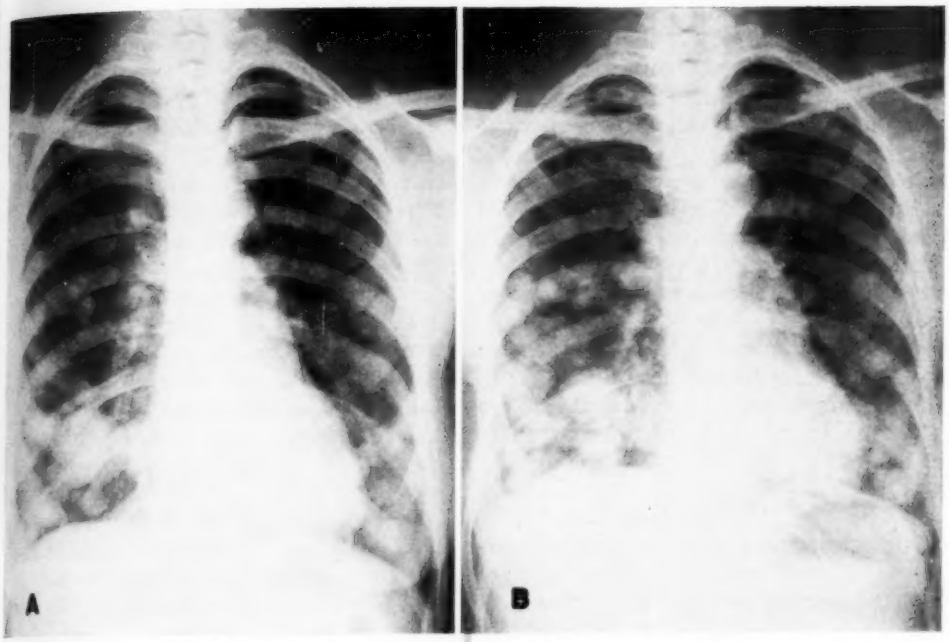

Fig. 4. Case 4. A. May 17, 1947. Many bilateral metastases are present but the patient is asymptomatic. The primary tumor was a pseudo-adenomatous basal-cell carcinoma of the left lacrimal gland. An admission photofluorogram, made Jan. 6, 1946 (one year and five months before this film), showed a single small metastasis in the lower right lung field.

B. Jan. 12, 1948. This roentgenogram, made two years after the initial photofluorogram and eight months after A, shows increase in size and number of the pulmonary lesions, but the patient still does not have pulmonary symptoms.

and a half years; the patient is in fair general condition.

CASE 5: O. W., a white female, age 49, was admitted to the University Hospital on Jan. 4, 1932, with a history of a tumor of the region of the right maxilla, which had been removed surgically seven years before; the operation was followed by radium treatment on three occasions. Recurrence appeared in the right side of the mouth in November 1931. The condition was deemed inoperable, and some x-ray treatment was given in February and March 1932, and repeated in June 1932; this produced no significant regression. Following a three-day course of x-ray treatment, a partial resection of the right maxilla was done on Dec. 28, 1932; three weeks later 140 mg. of radium in three capsules were packed into the cavity for an exposure of 2,800 mg. hr. Numerous examinations up to January 1935 failed to show any recurrence.

Pathological Diagnosis: Pseudo-adenomatous basal-cell carcinoma.

On Jan. 9, 1934, because of abdominal pain, x-ray examination of the colon was done. During the fluoroscopic part of this procedure, multiple large pulmonary metastases (up to 4 cm. diameter) were seen; chest films confirmed this observation. At this time, the patient had no pulmonary symptoms. (The size of the metastases and their slow rate of growth, as shown by subsequent events, indicate that they had been present for some time, possibly several years.) On the next check-up examination, Feb. 26, 1934, for the first time the patient complained of some shortness of breath on exertion and a hacking cough. These symptoms were still present at the last examination, on Jan. 21, 1935, and had increased moderately in severity. The cough was fairly well controlled by simple medication. The last chest roentgenogram was made on Dec. 18, 1934, and showed moderate increase in the size of the lesions.

No additional information is available regarding the clinical status of the patient until the time of death. She died elsewhere on Jan. 3, 1937 (three years after the pulmonary metastases were discovered) of a pulmonary hemorrhage. Cachexia was listed on the death certificate as a contributory factor. Postmortem examination showed no evidence of recurrence at the primary site. The right lung was completely replaced by metastatic carcinoma. Four-fifths of the left lung was occupied by metastases. Metastases were present in bronchial and mediastinal lymph nodes, pleura, spleen, and liver.

Comment: From the first operation to death, twelve years elapsed. The dura-

tion of the neoplasm prior to the operation is unknown. Asymptomatic pulmonary metastases of large size were accidentally discovered nine years after the first excision. These lesions were under observation eleven months after discovery, during which time they increased only moderately in size. This suggests a duration of several years prior to discovery. Of the five patients presented, this is the sole one exhibiting pulmonary symptoms. The patient died as a result of the pulmonary involvement, but it is of interest that almost three years elapsed between the onset of pulmonary symptoms and death, clearly indicating the sluggish rate of growth of the lesions.[3]

DISCUSSION

The pseudo-adenomatous basal-cell carcinoma, in common with other members of the mucous and salivary gland group of neoplasms, may pursue a course protracted over many years. Four of the 5 cases presented showed a duration of over twelve years, 2 patients being still alive thirteen and fifteen years after the onset of the disease. The unique feature of this tumor rests on the fact, demonstrated by these 5 patients, that the clinical course may extend over a period of years even though pulmonary metastases exist.

In 2 patients (Cases 2 and 3) the pulmonary metastases appeared ten and eight years, respectively, after the onset of the disease. Although the precise date of appearance of pulmonary lesions is not known in Cases 1 and 5, a fair assumption is seven to eight years after the disease began. In Case 5, pulmonary metastases were found sixteen months after the clinical appearance of the tumor; evidently the neoplasm was more aggressively malignant than in the other 4 patients.

The pulmonary metastases of this neoplasm present two striking and important features. Symptomatic indication of their presence appears late or not at all. At no time in the four and three-quarter years that pulmonary metastases were known to be present in Case 1 did any clinical manifestation appear. In Cases 2, 3, and 4, metastases have been present in the lungs for three, seven and a third, and two years, respectively, and the patients are alive and still free of pulmonary symptoms. In Case 5 pulmonary lesions were problably present for several years before cough and dyspnea developed.

The second feature is the sluggish rate of growth of the pulmonary metastases. Comfortable, asymptomatic existence may continue for years after they appear, as shown by Cases 1, 2, 3, and 4. In Case 5, in which dyspnea and cough appeared only when the lesions reached a large size, the slow growth rate is emphasized by the fact that the lesions did not kill the patient until three years after symptoms appeared.

The lessons to be learned from the point of view of clinical management of this disease are two. Awareness of the potentiality of metastasis to the lungs will stimulate the clinician to look for such lesions by roentgenographic examination even though symptoms are lacking and the patient is in good condition. Secondly, and this is probably the most important, the discovery of pulmonary metastases must not be interpreted as indicating an early or rapidly fatal outcome. The experience reported here in 5 cases clearly shows that years of asymptomatic and comfortable existence are compatible with the slowly growing pulmonary lesions. Above all, attempts to exercise control over the primary tumor or even to eradicate it should not be abandoned solely on the basis that pulmonary metastases have been found. In many instances, this will prove to be a serious mistake that may lead to death from the primary lesion, whereas the lung metastases might not have killed the patient for several years. Contrary to what may be expected in most malignant tumors, the appearance of pul-

[3] In addition to the 5 patients presented here, one of us (I. L.) has seen 2 patients with pseudo-adenomatous basal-cell carcinoma in consultation, in whom pulmonary metastases could be traced back for five years on chest roentgenograms. Both patients were free of pulmonary symptoms. In each patient, advanced recurrent neoplasm was present at the primary site.

monary metastases of the pseudo-adenomatous basal-cell carcinoma does not necessarily constitute an immediate terminal manifestation of the disease.

SUMMARY

Five cases of pseudo-adematous basal-cell carcinoma (mucous and salivary gland tumor) with metastasis to the lungs are reported. The evidence presented suggests that this neoplasm metastasizes relatively frequently. The growth rate of the pulmonary metastases, like that of the primary tumor, is slow, and the patient may be asymptomatic for years. Unless chest roentgenograms are made, the pulmonary lesions will be overlooked. Unlike most malignant tumors, the development of pulmonary metastases of this neoplasm does not necessarily presage an early fatal outcome.

Addendum to Case 4: Since submission of this article for publication, the patient has been seen on two subsequent occasions, in August 1948 and June 1949. Episodes of coughing with chest pain had developed (two years and eight months following the first demonstration of pulmonary metastases). These symptoms had increased somewhat when the patient was last seen and some dyspnea had appeared. Chest films made in August 1948 showed increase in size and number of pulmonary metastases. No evidence of local recurrence was present, but a node showing metastatic neoplasm was excised from the neck during the 1948 observation. No regional lymph node involvement could be detected on the patient's 1949 visit.

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SUMARIO

Metástasis Pulmonares del Carcinoma Basocelular Seudoadenomatoso (Tumor de las Glándulas Mucosas y Salivales)

Descríbense 5 casos de carcinoma basocelular seudoadenomatoso (tumor de las glándulas mucosas y salivales), con metástasis pulmonares. En 2 las metástasis se presentaron a los diez y ocho años, respectivamente, de la iniciación de la afección primaria. En los otros 3 no se conocía la fecha precisa de la aparición de las lesiones pulmonares, pero parece que fué ocho o diez años después de la aparición del tumor primitivo. Tres enfermos se hallaban todavía vivos a los tres, siete y dos años, respectivamente, del descubrimiento de las lesiones metastáticas del pulmón. De los otros 2, uno vivió hasta cuatro años y nueve meses y el otro hasta tres años después de observarse la neumopatía. Sólo en 1 de los 5 pacientes había síntomas imputables a la invasión pulmonar.

Los datos presentados denotan que el carcinoma basocelular seudoadenomatoso metastatiza con relativa frecuencia. El desarrollo de las metástasis pulmonares, lo mismo que el del tumor primario, es lento, y el enfermo puede permanecer asintomático por años enteros. A menos que se obtengan radiografías torácicas, las lesiones pulmonares pasarán desapercibidas. En contraposición a lo que sucede en la mayoría de los tumores malignos, la formación de metástasis pulmonares no augura forzosamente un desenlace letal temprano.

Fictitious Polyps as Seen in Double-Contrast Studies of the Colon[1]

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Temple, Texas

THE FIRST RECORDED use of air studies of the colon was in 1896, when Becher made roentgenograms of the stomach and isolated loops of the large intestine after filling them with lead acetate solution as well as inflating the bowel with air (11). Following this, various phases of the technic were described. In 1909 Groedel recommended the bismuth clysma. About the same time Haenisch developed the trochoscope, forerunner of the present day horizontal fluoroscope (2).

Barium solution replaced bismuth salts as an opaque material about 1911. Growing appreciation of mucosal pattern visualization, stimulated by the work of Forssell and others, led to the technic of combining the simple opaque enema with injection of air. Between 1911 and 1923 such names as Rieder, Haenisch, Schwarz, Stierlin, Groedel, Case, George, Carman, and Sampson are associated with the methods then at hand (11).

In 1925 Fischer described his combined method of barium enema and injection of air (3). This method has been used and modified by many; Berg and Schwarz taking the lead in Europe, with Weber and Gershon-Cohen deserving the most credit for popularization of the procedure in this country.

It is the purpose of this paper to present roentgenograms of some colons studied by the double-contrast method, in which shadows resembling true polyps in every respect were visualized, but were found on later examination to have disappeared, or to have shifted in their position to an extent that they could be eliminated as representing true polyps. Weber (10) states that, "it is probable that polypoid lesions 2 cm. or less in diameter will almost always elude most careful roentgenoscopy or at least leave the examiner in an insecure state of mind regarding the reliability of his interpretation." Gershon-Cohen points out that limitations of the routine barium enema are due to inability to palpate portions of the colon, inability to fill the colon completely, and the impossibility of demonstrating early mucosal changes such as polyps, adenomas, ulcers, and cancer. Double-contrast studies are often the only means of demonstrating these small lesions (4). It is in such small shadows, necessitating double-contrast examination, that we are primarily interested in this discussion.

Because these shadows are not produced by true polyps, and to avoid confusing them with "secondary polyps" which develop on the healing inflamed mucosa of chronic ulcerative colitis and are often referred to as "pseudo-polyps," we shall refer to them as "fictitious" polyps of the colon (1). In reviewing the literature relative to studies of the colon, we have found no reference to such shadows.

The consideration of this condition was brought forcibly to our attention in 1942 by the following case.

CASE I: A middle-aged white woman presented herself at the Scott and White Clinic for examination, complaining of "bleeding from the rectum." She had passed both bright and dark blood. Proctoscopic examination revealed internal and external hemorrhoids, as well as multiple rectal polyps. Multiple shadows demonstrable in the colon by double-contrast study were also interpreted as polyps (Fig. 1A). The patient was seen by a surgical consultant and the rectal polyps were removed by fulguration. She was advised that a colectomy might be required and was instructed to return in about three months for re-examination. This second examination, with the same technic as the first, showed the colon to be entirely normal above the proctoscopic level (Fig.

[1] From the Scott and White Clinic, Temple, Texas. Accepted for publication in September 1948.

[2] Fellow in Radiology, Scott and White Clinic.

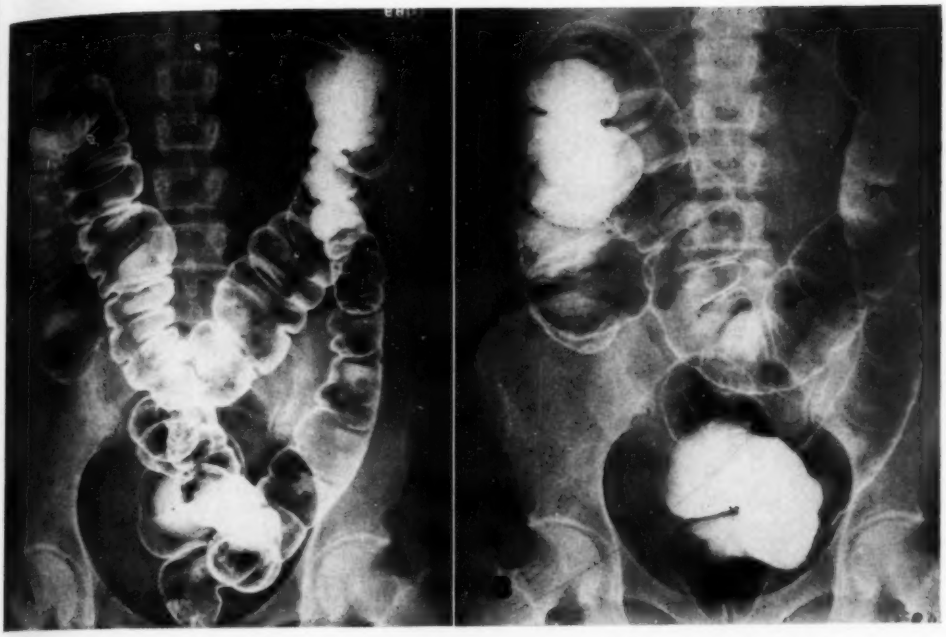

Fig. 1. Case I. A. Double-contrast study of the colon showing multiple non-opaque shadows interpreted as polyps. B. Re-examination three months later, revealing no evidence of polyps.

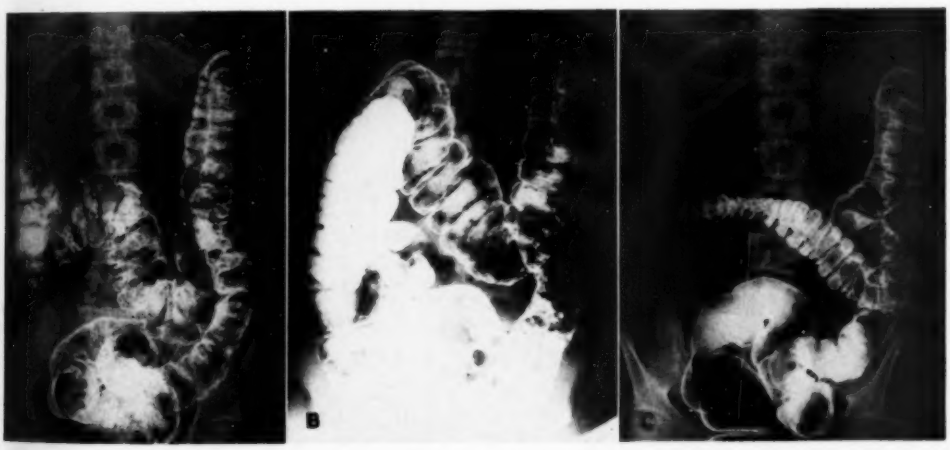

Fig. 2. Case II. A. Double-contrast study producing the picture of diffuse polyposis of the colon in a patient not properly prepared for examination. C. Re-examination after proper preparation, revealing complete absence of confusing shadows. A double-contrast study of the colon in a proved case of polyposis (B) is reproduced to show the similarity of the picture to A.

1B), and subsequent examinations at six-month intervals have failed to reveal any pathologic changes. During the course of further questioning it was found that the patient had taken mineral oil daily by mouth over a long period of time prior to the first examination. This suggested the possibility of the fictitious polyps being actually oil globules.

Since this experience, we have been on the alert for such shadows and have found them to occur not infrequently. We were further encouraged to report this condition by an internist (12) who recently had a patient who stated that she

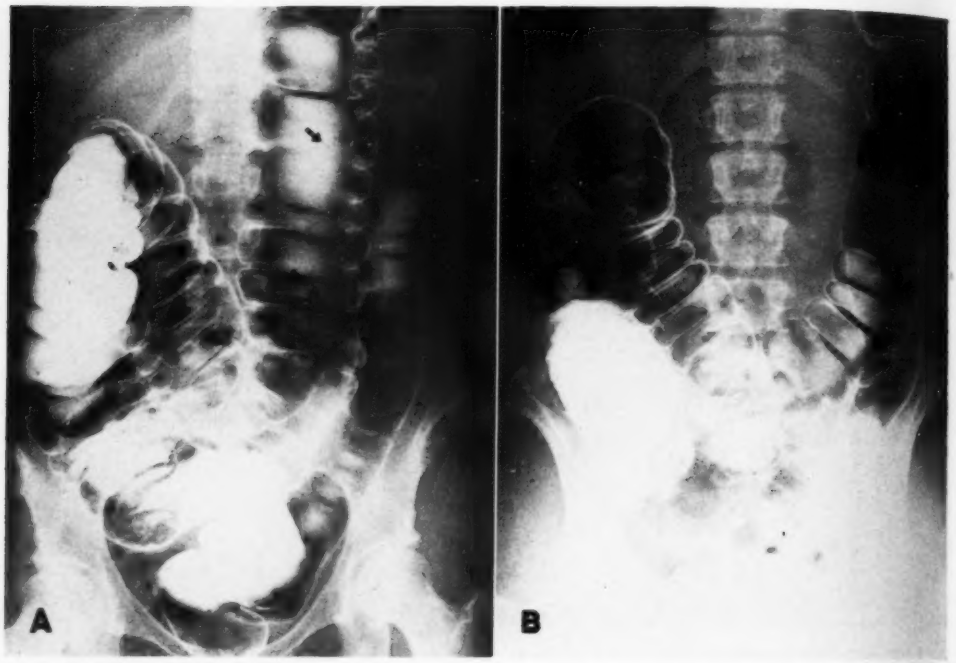

Fig. 3. Case III. A. Double-contrast study of the colon showing multiple non-opaque shadows simulating polyps. B. Absence of polyp-like shadows on re-examination.

had been cured of polyps in the colon by medical treatment.

At this point, we would like to state that we d'sagree with those who do not consider laxatives and enemas necessary preparation for a thorough examination of the colon. As stated elsewhere (8), our only contraindications to purgation are severe diarrhea, severe intestinal hemorrhage, and acute or subacute obstruction. Some of our colleagues do not feel that purgatives are necessary and others believe that the social level of the patient is a factor to be considered (9).

To illustrate the necessity for thorough cleansing of the large bowel prior to examination and to show the importance of re-examination before arriving at a final diagnosis, we are presenting histories of a number of patients.

CASE II: A middle-aged white woman, from the so-called "elite" level of society, was referred to our department for examination of the colon for suspected polyposis. On entering the examining room, she stated that she had been to a party the evening before, having had excellent hors d'oeuvres and champagne. Her referring doctor had told her she need not take castor oil, but she had had some enemas that morning. Double-contrast studies of the colon presented the picture of diffuse polyposis (Fig. 2A). Re-examination after thorough and proper preparation, two days later, revealed a negative colon above the proctoscopic level (Fig. 2C), much to the relief of all concerned.

CASE III: A 29-year-old white woman registered at the Scott and White Clinic, Aug. 18, 1947, complaining of being "run down and weak." History revealed excessive fatigue, constipation, and backache, dating from childbirth six years previously. The patient had been taking laxatives regularly, usually mineral oil. The only significant finding on physical examination was a retroversion of the uterus. Proctoscopic examination showed a sessile polyp at 13 cm. This was removed and found to measure 5 mm. in diameter. Double-contrast studies of the colon revealed multiple non-opaque shadows in the bowel (Fig. 3A). It was believed that these might represent oil globules, and re-examination was requested. Though the same technic was employed, there was no evidence of the shadows previously noted (Fig. 3B).

CASE IV: A 54-year-old white woman registered at the Scott and White Clinic on Nov. 7, 1946, complaining of "hurting in the chest, cough, and fast heart beat." Her only gastro-intestinal complaint

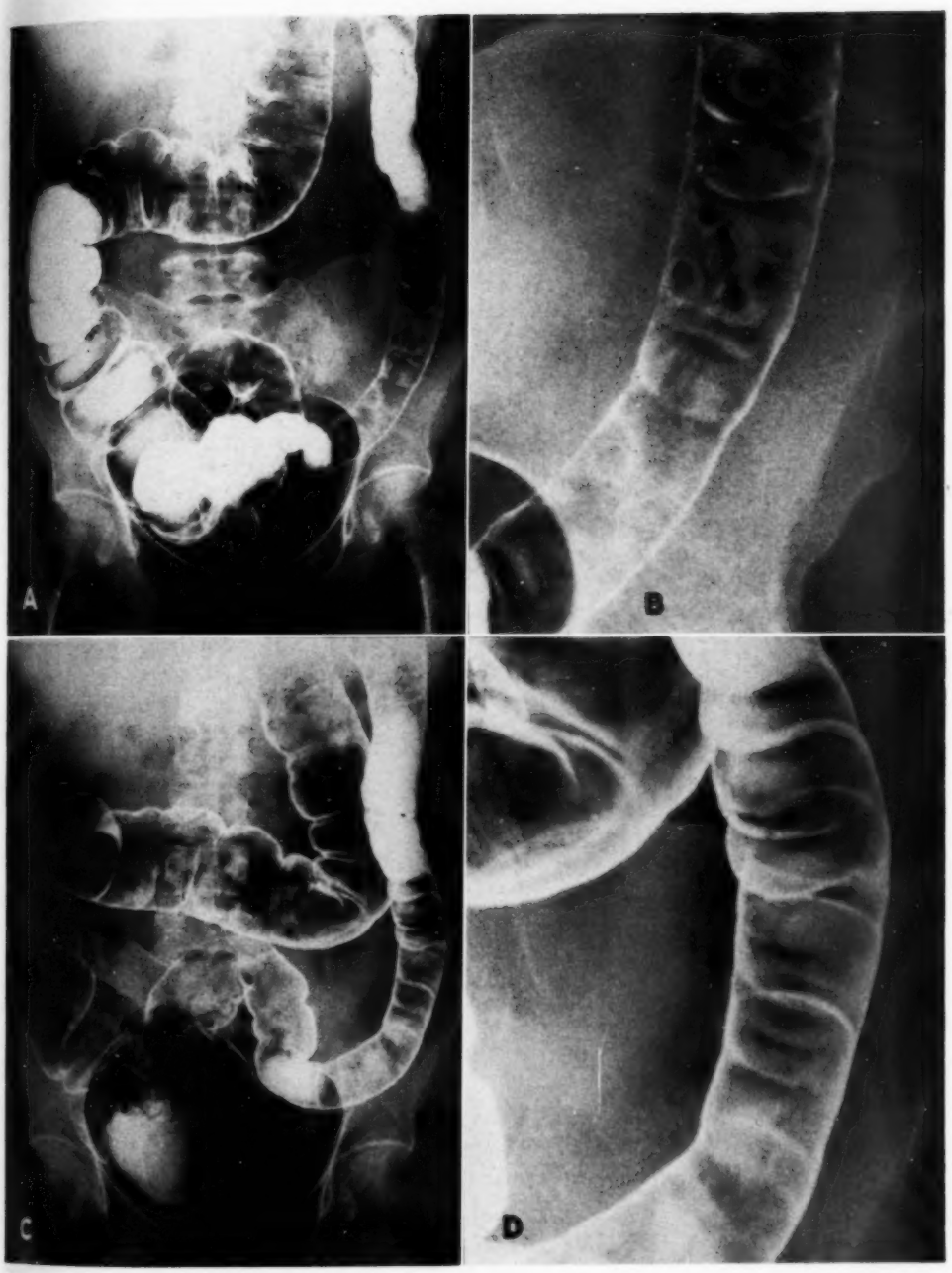

Fig. 4. Case IV. A. Double-contrast study revealing multiple polyp-like shadows in the descending colon. B. Localized view of involved section of the colon for better visualization. C and D. Re-examination of colon, showing absence of shadows.

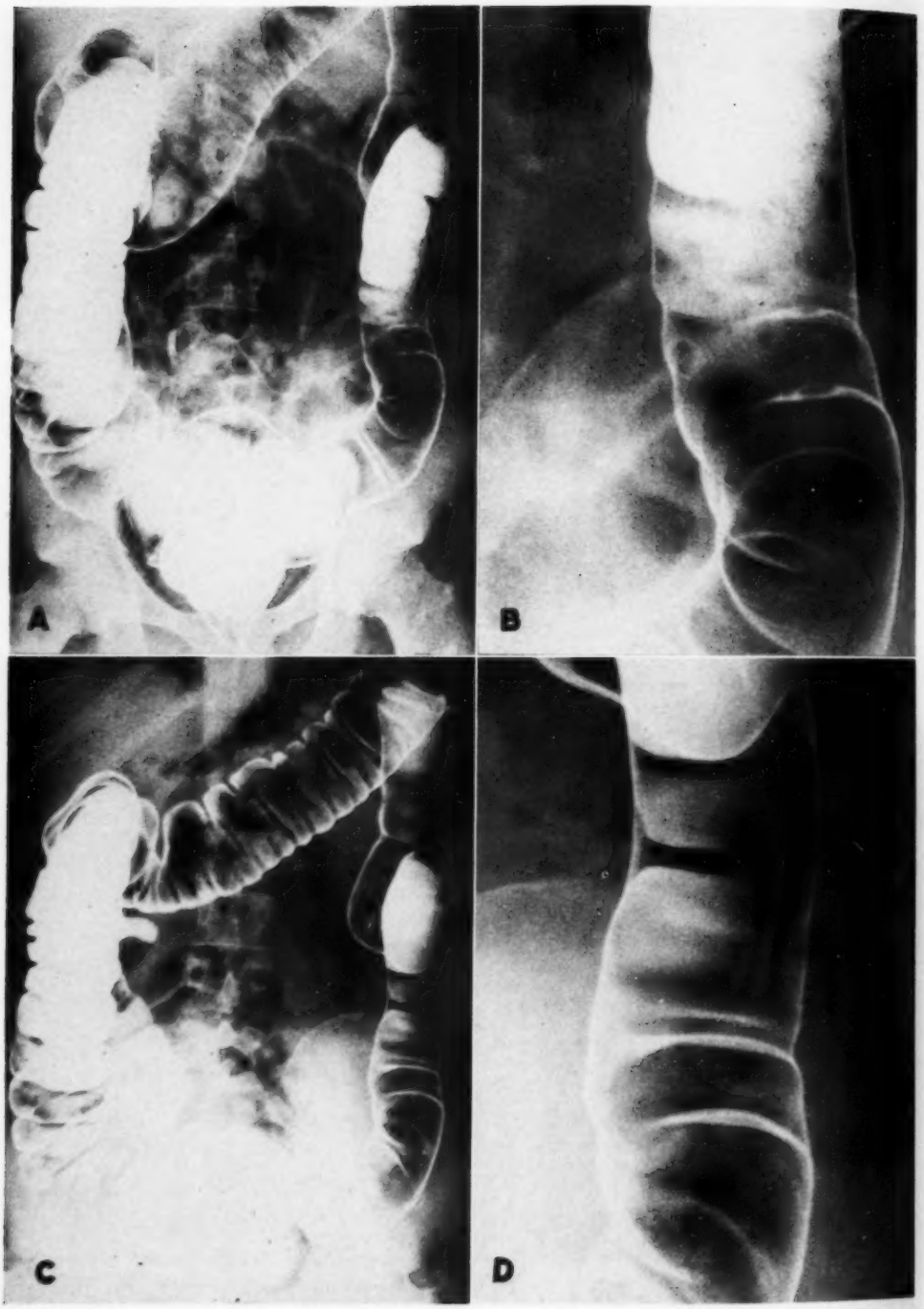

Fig. 5. Case V. A. Double-contrast study revealing non-opaque polyp-like shadows in the descending colon. B. Localized area of descending colon showing polyp-like shadows in better detail. C and D. Absence of shadows on re-examination.

was the necessary daily use of laxatives. Further questioning revealed that she had had black stools for the preceding week, with no history of causative medication. Physical examination was essentially negative. Colon examination by the double-contrast method revealed multiple rounded shadows in the descending colon (Fig. 4A and B). These were suspected of being fictitious polyps and re-examination was suggested. The second examination revealed no evidence of the shadows seen in the earlier film (Fig. 4C and D).

CASE V: A 29-year-old Mexican physician registered at the Scott and White Clinic on June 17, 1948, his chief complaint being rectal hemorrhage. His first hemorrhage, of red blood, had occurred in 1943. In May 1947, he passed black stools for two days and went into shock from hemorrhage. Physical examination was essentially negative. Internal and external hemorrhoids were found on proctoscopic examination. Fluoroscopy showed a duodenal ulcer. Double-contrast examination of the colon revealed four non-opaque shadows in the descending colon which might represent polyps (Fig. 5A and B). A repeat examination was carried out the next day and the shadows were no longer present (Fig. 5C and D). Again, it was felt that these were fictitious polyps.

CASE VI: A 42-year-old white man was seen at the Scott and White Clinic on Dec. 10, 1947, complaining of "stomach trouble." His history was in keeping with peptic ulcer. Physical examination

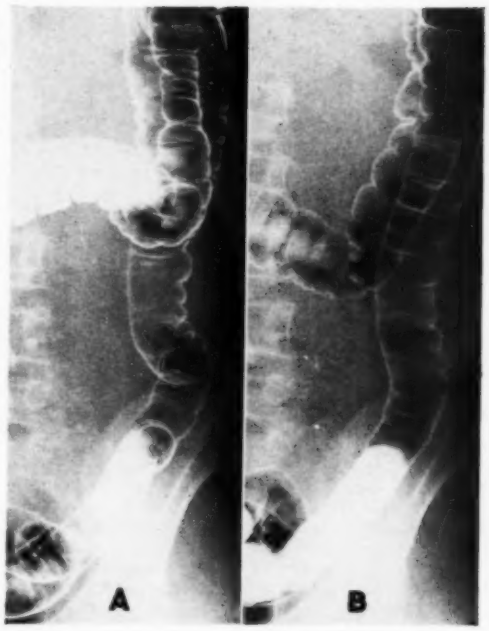

Fig. 6. Case VI. A. Double-contrast study revealing a single polyp-like shadow in the descending colon. B. Re-examination the following day, showing absence of shadow.

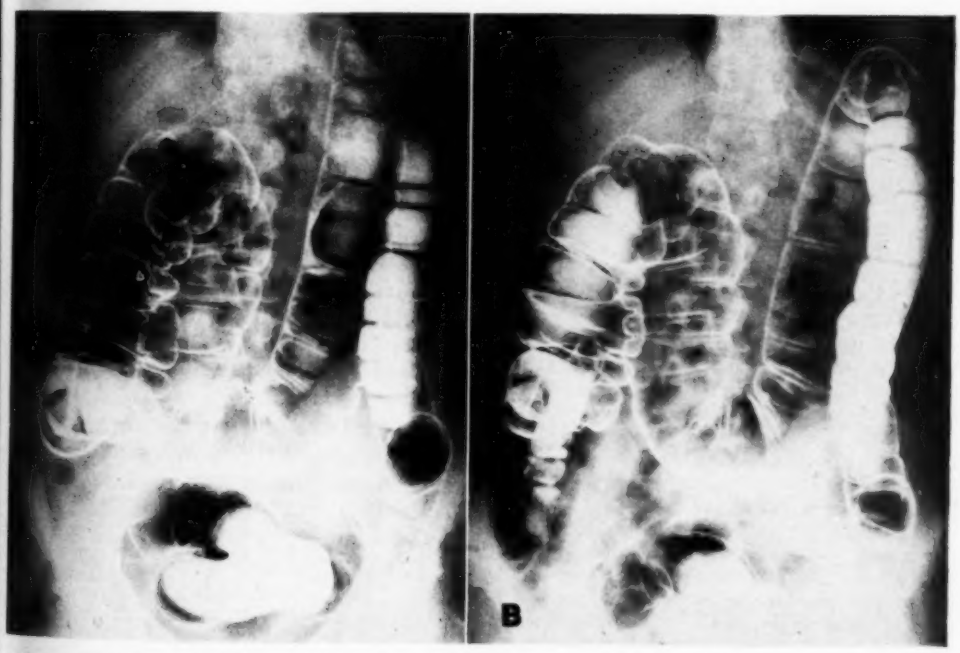

Fig. 7. Case VII. A. Double-contrast study revealing an atypical shadow in the distal transverse colon. B. Re-examination by the same technic. No shadow is present.

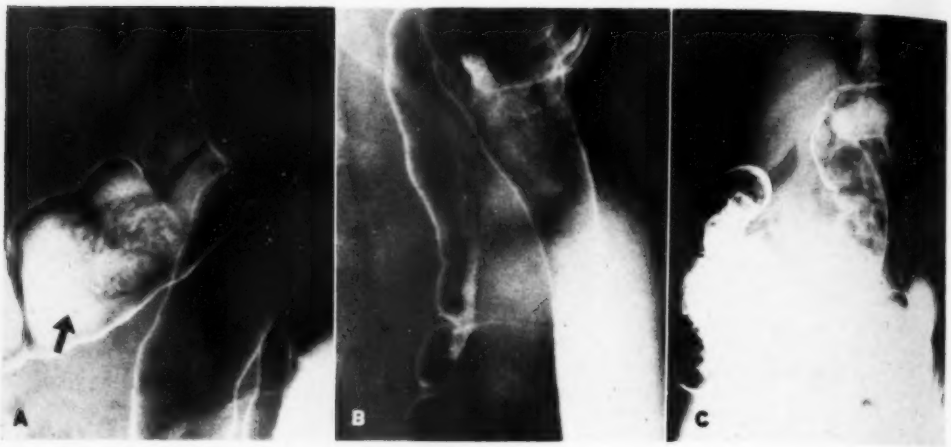

Fig. 8. Case VIII. A. Double-contrast study revealing a polyp-like shadow with pedicle attached to the transverse colon. B. Rotation of the patient from the prone to the supine position brought about a change in the unattached portion of the polyp-like shadow, while the attached end of the "pedicle" remained unchanged. C. Re-examination the following day, by the same technic, was entirely negative in both the prone and supine positions.

was negative. Proctoscopic examination revealed a polyp at 22 cm., 8 mm. in diameter. Double-contrast examination of the colon revealed a single shadow in the descending colon (Fig. 6A). Re-examination the next day showed no pathologic change (Fig. 6B). The previous shadow was no longer present.

CASE VII: A 51-year-old white man presented himself at the Scott and White Clinic on June 16, 1948, for general examination. His chief complaint was headaches. He had suffered from indigestion and constipation but had passed no blood in his stools. A general examination was essentially negative. A double-contrast study revealed a shadow in the transverse colon which might be a polyp (Fig. 7A). A second examination was carried out the following day, using exactly the same procedure, and the shadow in question was not present (Fig. 7B). Again we were dealing with a fictitious polyp.

CASE VIII: A 46-year-old white woman registered at the Scott and White Clinic, May 15, 1948, complaining of rectal bleeding of one year duration. The blood was usually bright red, but occasionally dark. Bleeding was not always associated with bowel movement. The patient was a chronic laxative taker. She had had hemorrhoids removed on two occasions. Physical and proctoscopic examination revealed abdominal scars from previous surgery, hemorrhoids (grade I), and an anal fissure. A double-contrast study revealed a polyp-like shadow with a rather long pedicle in the distal transverse colon (Fig. 8A and B). Re-examination was carried out in a similar manner the next day, and the shadow was not present (Fig. 8C). It is believed that the confusing shadow in this case, as in Case VII, was probably due to a mass of undigested fibers in the colon (7).

DISCUSSION

In a series of 2,013 colon examinations the effectiveness of various forms of preparation was studied. In this series 267 double-contrast examinations were performed. The indications for these were (1) unexplained anemia, (2) blood in the stool, not otherwise explained, (3) a history of polyps, and (4) further study of previously found lesions for more detail.

Of the 267 colons studied by the double-contrast method, 63 (23.5 per cent) showed fictitious polyps. It was found that the occurrence of these shadows was affected by diet, type of laxative administered, and type of lubricant used on the enema-tip. A complete report on these factors in relation to fictitious polyps is in preparation.

In a majority of cases the polyp-like shadows could be differentiated from true polyps by changes in size, shape, and position, as demonstrated in supine and prone projections. In many instances, re-examination was the only definite means of differentiation.

SUMMARY

1. Eight instances of fictitious polyps are presented, with illustrations showing their similarity to true polyps.

2. These were encountered in 23.5 per cent of 267 double-contrast studies of the colon.

3. Thorough preparation, including adequate purgation, is required for proper examination.

4. Re-examination is recommended for confirmation in all suspicious instances.

5. The diet immediately prior to examination, the type of laxative used in preparation of the patient, and the type of lubricant employed on the enema-tip have a noticeable effect on the occurrence rate of fictitious polyps.

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SUMARIO

Los Falsos Pólipos según se Observan en los Estudios de Doble Contraste del Colon

En 63 de 267 casos en los que se hicieron estudios de doble contraste del colon, obsevároнse imágenes semejantes en todos sentidos a las de los pólipos verdaderos, pero que al reexaminar con la misma técnica, o habían desaparecido o cambiado de posición a tal punto que podía excluirse el diagnóstico de poliposis. A esas imágenes se las denomina "falsos pólipos," para diferenciarlas tanto de los pólipos verdaderos como de los llamados "seudopólipos" que se forman en la mucosa en vías de cicatrización en la colitis ulcerada crónica.

Comunícanse 8 casos, demostrando la necesidad de la preparación adecuada para el examen, incluso el empleo de laxantes y enemas, y la importancia del reexamen para la confirmación de los casos sospechosos.

Descubrióse que la ocurrencia de falsos pólipos se ve afectada por la alimentación inmediatamente antes del examen, la clase de laxante usada en la preparación del enfermo y la clase de lubricante empleada en la cánula de la jeringa. El papel desempeñado por esos factores constituye el tema de un trabajo por publicar más tarde.

New Method for Roentgen Anatomical Study of the Skull[1]

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AN UNDERSTANDING of the details of the anatomy of the skull as shown in roentgenograms is attended by many difficulties because of the confusing multiplicity of lines and shadows. To meet this problem it seemed reasonable to attempt a roentgen anatomical dissection of the skull by disarticulating the component bones and making separate films of each in various standard projections in order to determine exactly what features it contributed to the complete picture. Such a method of analysis is quite simple, as we are able, when dealing with only one bone, to identify definitely the anatomic features in the individual roentgenogram, if need be by affixing a lead marker to any questionable point. Then, if one makes a film of the skull with the bone under study removed, it is readily apparent what parts are missing and certain features contributed by other bones can be more readily identified. Finally, when a film of the whole skull is made, with the part in question restored, one can, by comparison with the film of the single bone, pick out the exact features it contributes and thus clarify previously confusing structures. With this completely detailed film as a guide, it is possible to correlate known structures with those shown roentgenographically in the living subject. It is believed that this method of roentgen analysis of the bones of the skull will help to clarify some clouded anatomical points and provide a means for correlating proved anatomical features with doubtful shadows on the roentgenogram.

In order to illustrate clearly and label the anatomical features delineated by the above system of study, a new method of mounting was developed. This consists of cutting out from the black background of the film the silhouette of the part under study and gluing this to a piece of cleared film in order to give room for lettering. This method obviates use of overlays, reference letters, and numbers with accompanying legends. Such a film can then be photographed for prints, as in the accompanying illustrations, or slides may be made. By placing the films between two sheets of plexiglas and binding these with mounting tape, permanent mounts for study and exhibit purposes can be prepared.

One of the most interesting bones of the skull for a study of this kind is the sphenoid. It is in the very center of the cranium and enters into practically all roentgenographic views. If we place it in the position it would occupy in the skull in the Waters projection for filming the maxillary sinuses, some striking features are seen at once (Fig. 1). The superior orbital fissure with the foramen rotundum at its lower extremity is shown, and the foramen ovale at the junction of the base of the spine with the lateral pterygoid plate. The diagonal line seen in the lateral portion of the orbit is shown to be a cross-section of the squamozygomatic surface of the greater wing of the sphenoid bone. In Figure 2, with this bone removed, all the features described above are missing, and lines and shadows caused by other bones can now be separated. Replacing the sphenoid bone and making another view in the same projection (Fig. 3) make possible integration of the individual components found in the single bone. Finally, in Figure 4 of the

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[1] Read by title at the Thirty-fourth Annual Meeting of the Radiological Society of North America, San Francisco, Calif., Dec. 5–10, 1948. An exhibit, under the same title, was also presented at the meeting. This work has been aided by a grant for research from the Sarah Mellon Scaife Foundation of Pittsburgh.

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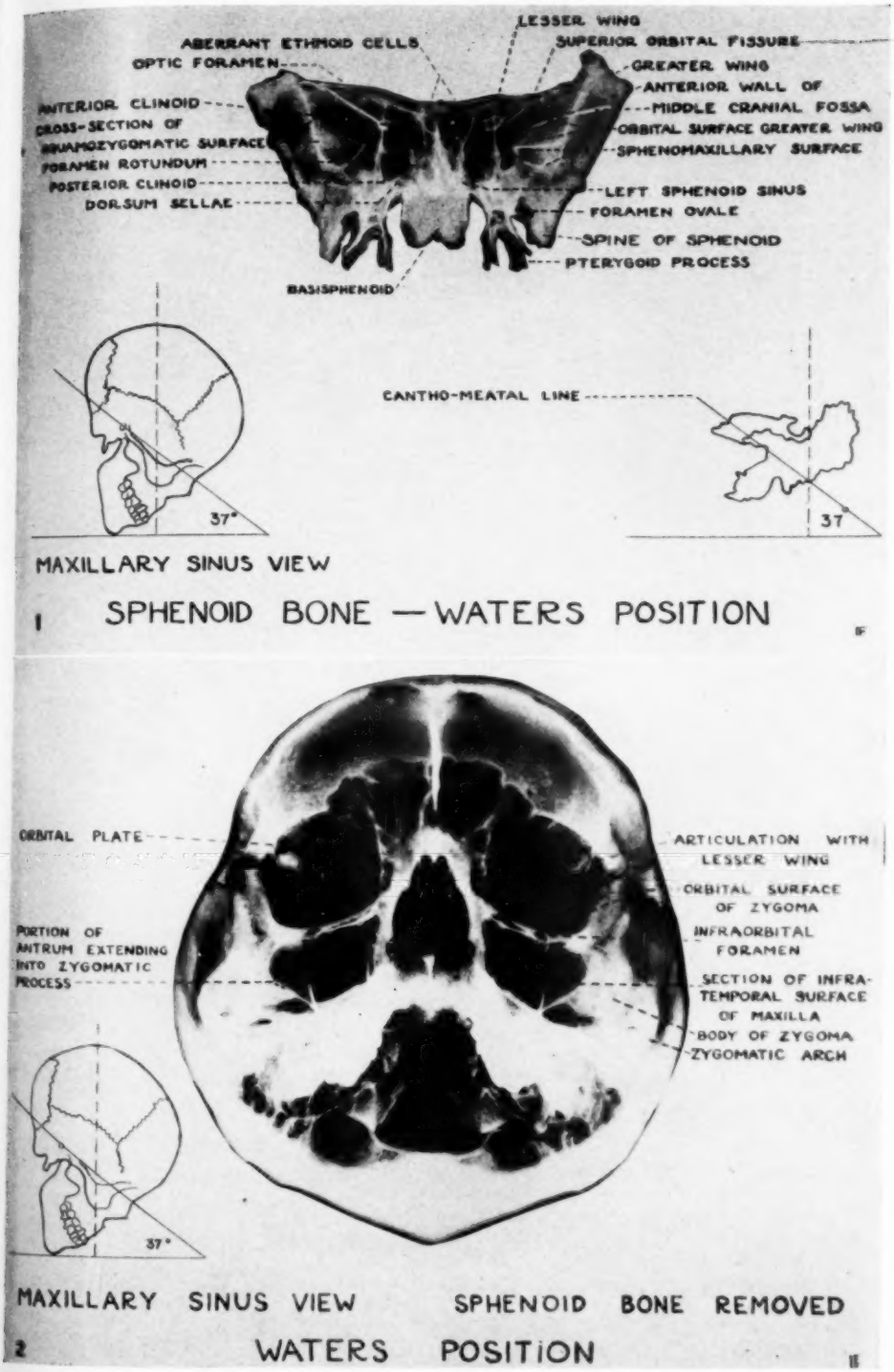
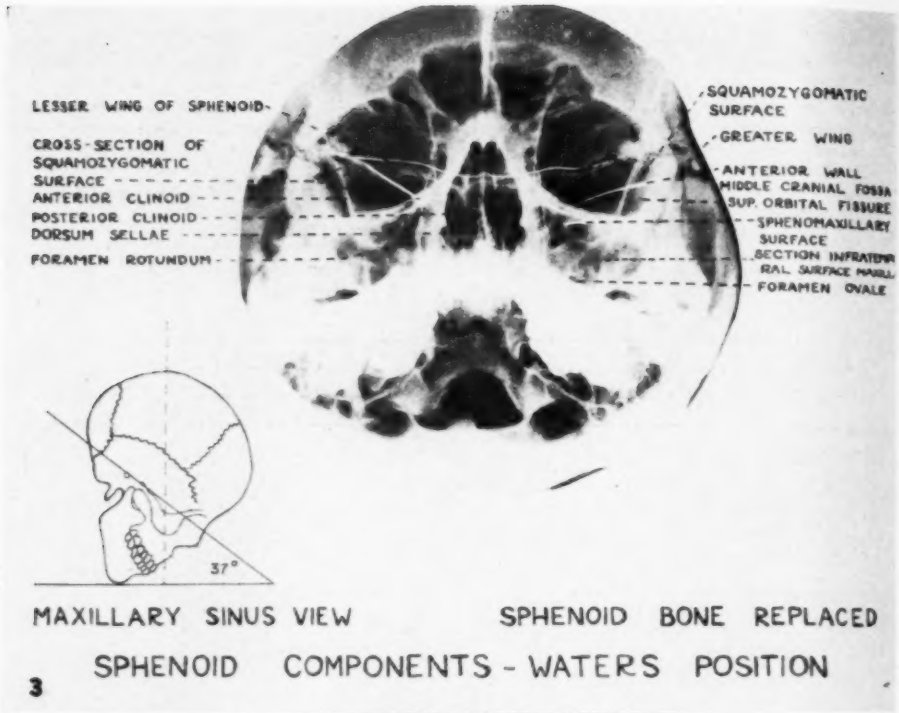
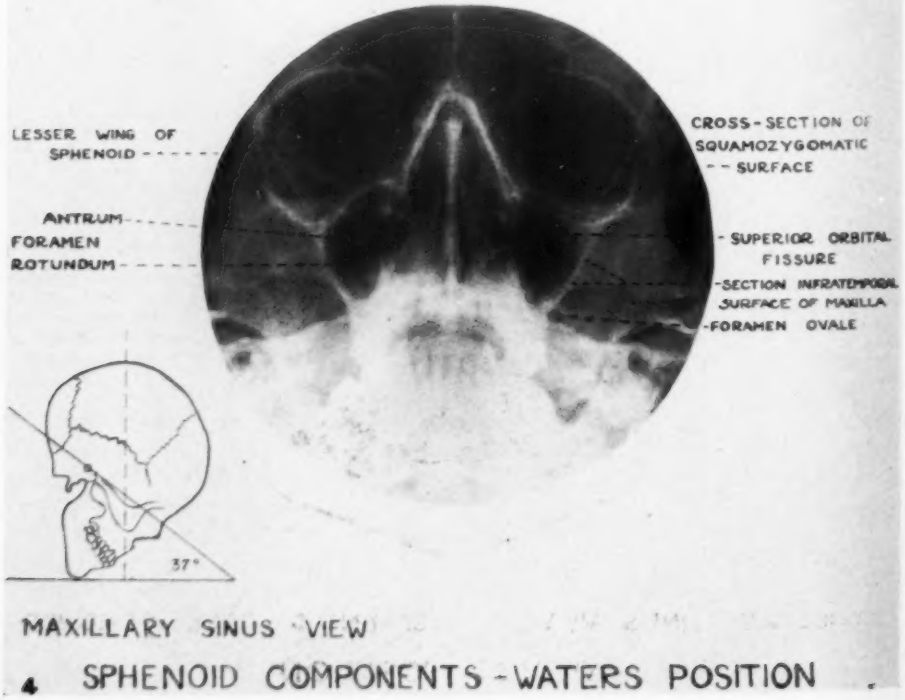
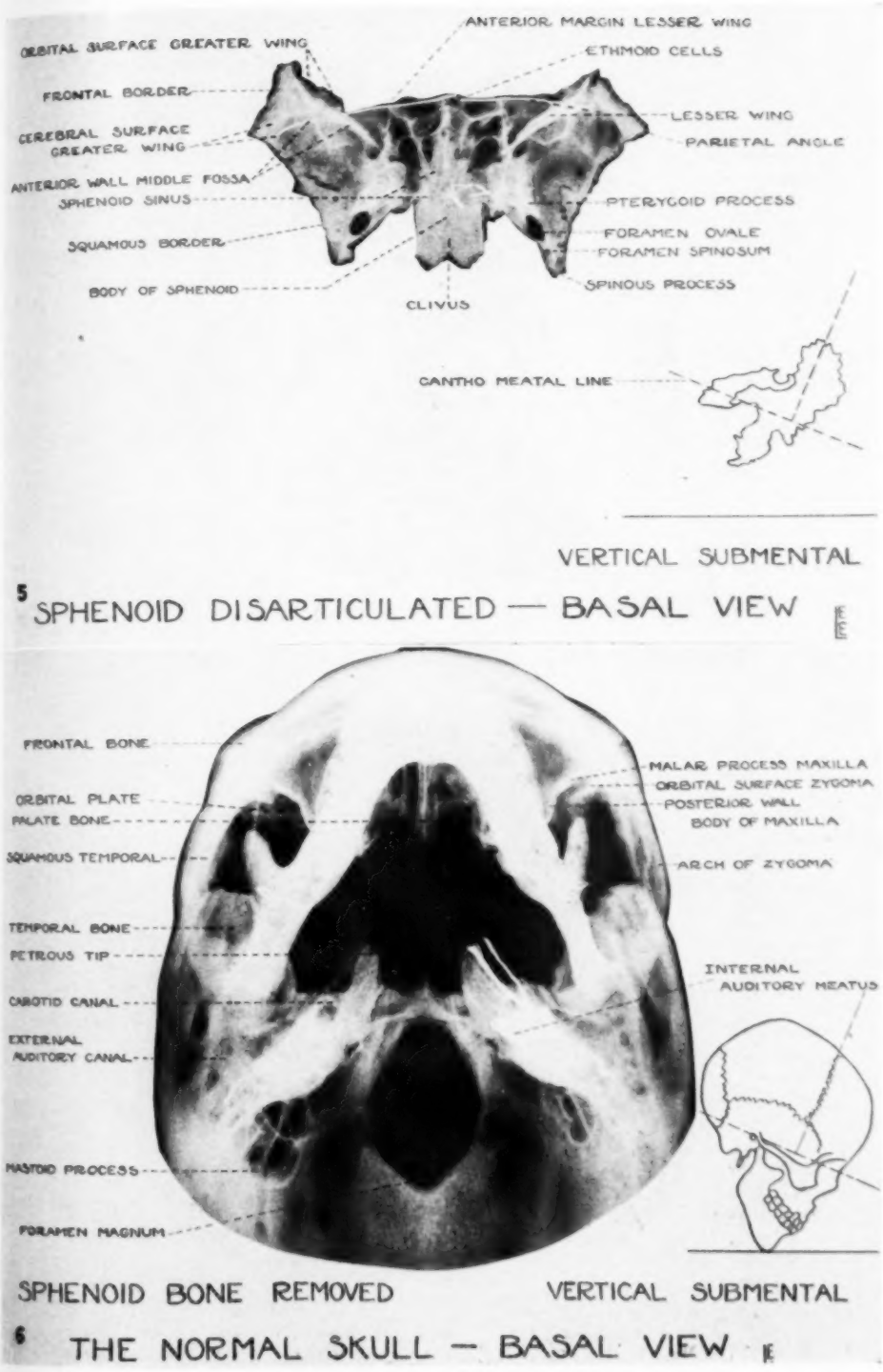


Figures 1 and 2.

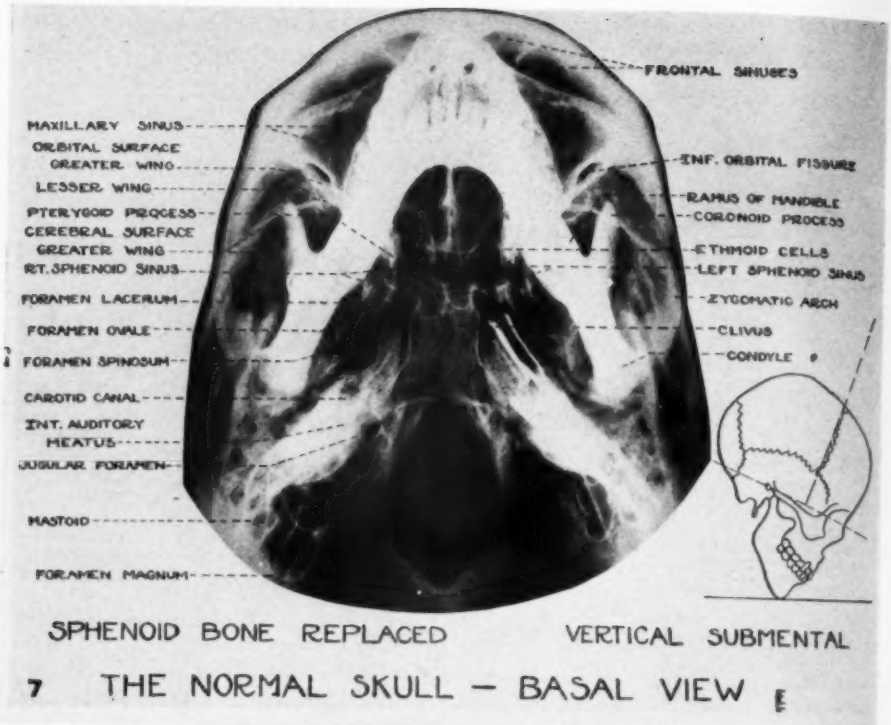


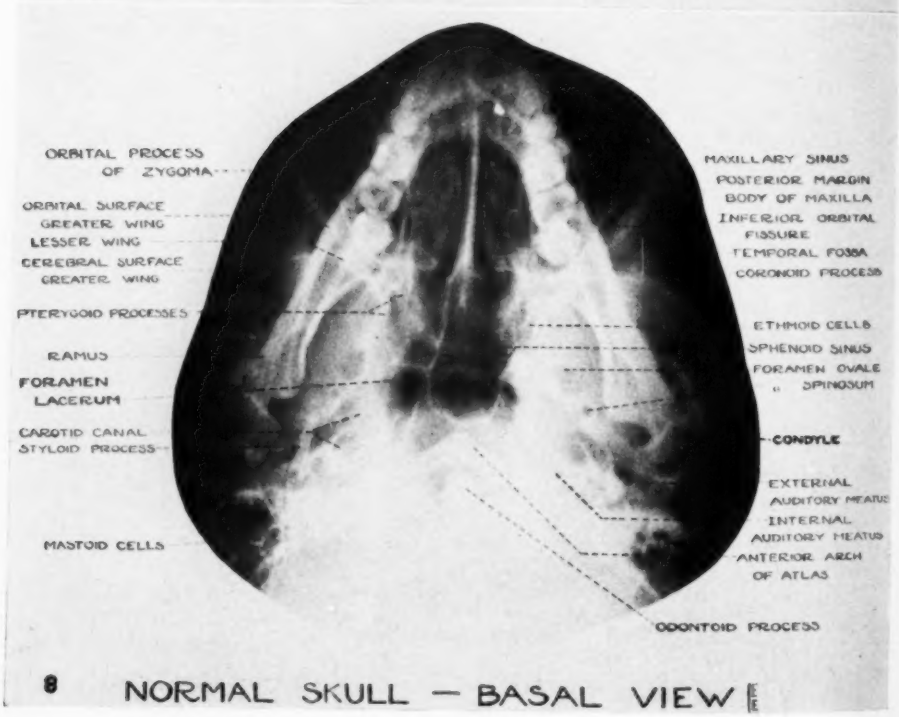


Figures 3 and 4.

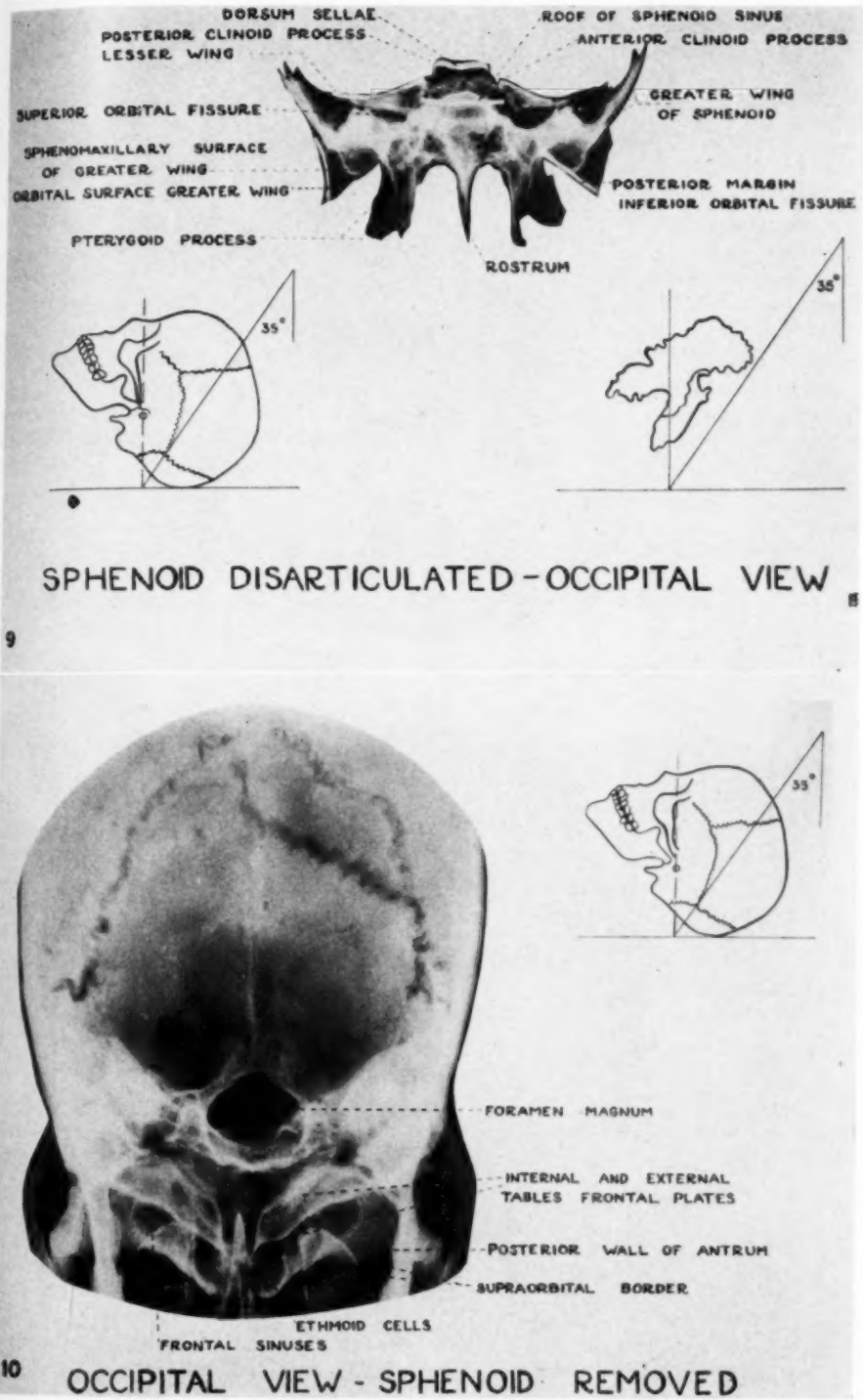


Figures 5 and 6.

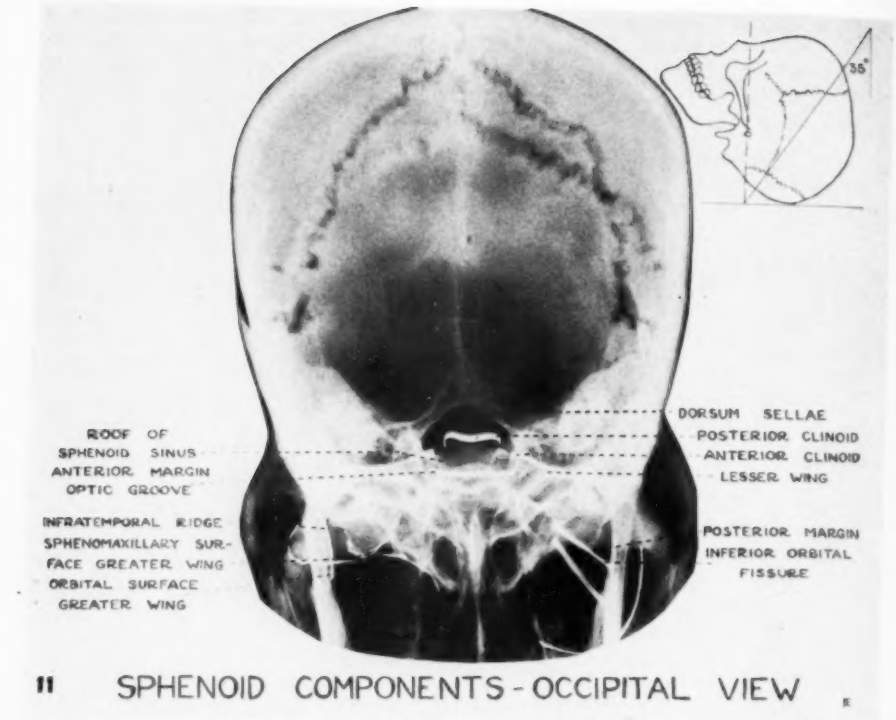




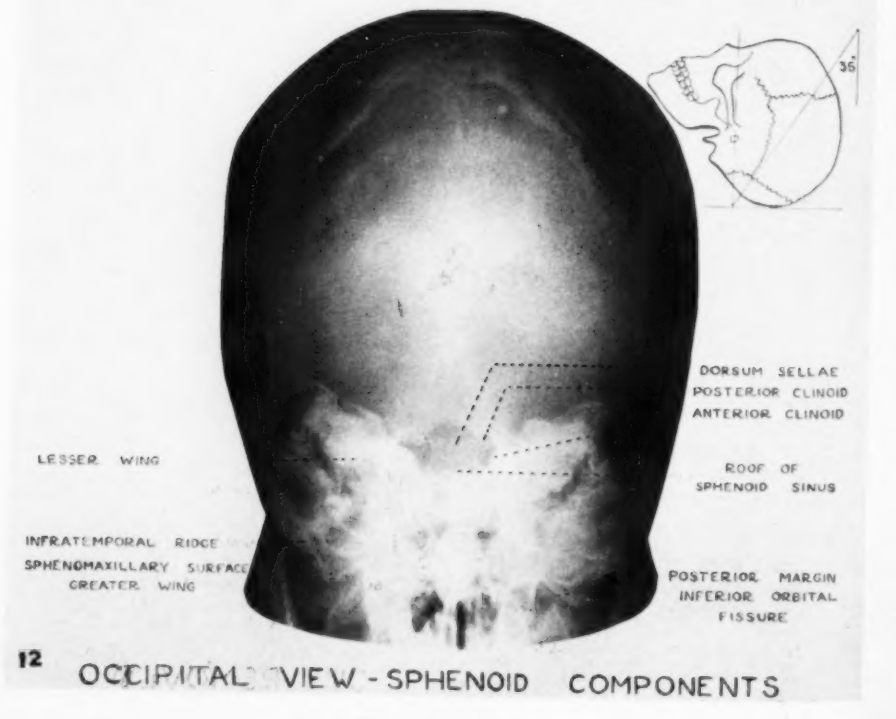
Figures 7 and 8.



Figures 9 and 10.



11 SPHENOID COMPONENTS - OCCIPITAL VIEW



12 OCCIPITAL VIEW - SPHENOID COMPONENTS

Figures 11 and 12.

living subject, many points can be oriented in the light of the foregoing dissection. Needless to say, not all the landmarks are clearly shown on any one film, some being better for one or another detail.

Similar study of the sphenoid placed in the position it assumes in the verticosubmental or basal view shows some unsuspected features (Fig. 5). With lead strips in place, the crescentic curve of the cerebral surface of the greater wing of the sphenoid bone is seen to coincide with the lateral margins of the lesser wings, forming one continuous line. This line constitutes the anterior wall of the middle cranial fossa. The orbital surface of the greater wing runs diagonally lateralward and forward, forming the posterior margin of the sphenomaxillary fissure. The sphenoid sinuses are clearly depicted and their close relationship with ethmoid cells, from which they cannot be separated, is seen. When a film of the skull is made with the sphenoid removed(Fig. 6), it is apparent how much is missing, and the features of this projection contributed by other bones are clearly appreciated. It will be noted that the orbital surface of the zygoma projects backward and medialward to join with the corresponding orbital surface of the greater wing to form a continuous line, the posterior margin of the inferior orbital fissure. This is best shown in Figure 7, with the sphenoid replaced. Here the sphenomaxillary fissure is clearly shown between the posterolateral surface of the maxilla and the orbital surface of the greater wing. On comparison of the individual components developed in the foregoing studies, most of the anatomical details can be analyzed in the film of the living subject (Fig. 8).

A study of the sphenoid bone in the occipital projection is intriguing. Here some quite unpredicted features are seen (Fig. 9). The rather small sphenomaxillary surface is projected downward as a slightly exaggerated pyramid and could easily be mistaken for the tip of the mastoid process of the temporal bone. This sphenomaxillary surface forms the posterior margin of the inferior orbital fissure. In Figure 10, with the sphenoid removed, features contributed by other bones, particularly the frontal, are well shown. With the sphenoid replaced (Fig. 11), the points above described are seen, particularly the sphenomaxillary surface and inferior orbital fissure. The lesser wings are also noted to contribute considerable density to what is ordinarily thought of as only the petrous pyramid of the temporal bone. Finally, in the roentgenogram of the living skull in the occipital view (Fig. 12), the anatomical landmarks above described can be located and their relationships thoroughly understood.

It is believed that this method of study of roentgen anatomy of the skull is of value for clearly labeling films for classroom instruction and demonstration, and that, by disarticulating the several bones and filming them separately, great help is furnished in discerning exact anatomical relationships.

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SUMARIO

Nuevo Método para el Estudio Roentgeno-Anatómico del Cráneo

La técnica propuesta permite obtener una comprensión mejor de los detalles de la anatomía del cráneo según los revela la radiografía, consistiendo en desarticular los huesos componentes y hacer radiografías separadas de cada uno en las proyecciones corrientes. En esas películas pueden identificarse las características anatómicas de cada hueso, en tanto que las radiografías del cráneo, después de retirar los huesos, mostrarán qué partes del cuadro completo faltan y revelarán más claramente ciertas características aportadas por otros huesos. Por fin, cuando se obtiene una radiografía de todo el cráneo, con las partes que faltaban repuestas, se puede, por

comparación con las radiografías de los huesos separados, distinguir las características exactas que aportan, poniendo así en claro tejidos antes confusos. Tomando por guía esta radiografía detallada completa, es posible correlacionar tejidos conocidos con los revelados por la radiografía en el sujeto vivo.

Para fines de enseñanza y de exhibición, puede recortarse la silueta de la parte en estudio del fondo negro de la película y engomarse en un trozo de película aclarada, con una inscripción adecuada.

Van adjuntas ilustraciones de un estudio del esfenoides con la técnica descrita.

Calcification in Sympathoblastoma (Neuroblastoma)[1]

F. B. MANDEVILLE, M.D.

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IN A PREVIOUS paper (8) on primary neoplasms of the sympathetic nervous system, more particularly the sympathoblastoma or so-called neuroblastoma, we mentioned that calcification in the tumors, if noted on the roentgenogram, may be helpful as an aid in preoperative diagnosis. This was merely re-emphasizing an observation made in the literature by numerous pathologists, radiologists, and clinicians. Recent experiences suggest this to be advisable.

In 1947, Murray and Stout (9) described the distinctive characteristics of the sympathicoblastoma cultivated *in vitro* and showed that tissue culture as a method of examination can be very helpful in questionable cases. One of their series of 8 cases (Case 5) was that of a six-year-old boy with a mediastinal mass projecting into the right pleural cavity. It pushed the trachea forward and the arch of the azygos vein downward. The child died three and a half months after operation. "Microscopically the tumor was made up of sympathicoblasts which formed a considerable number of pseudorosettes and was extensively necrotic. It was found in a mediastinal node and involved a partly calcified sympathetic ganglion." Calcification was also found microscopically in the adrenal of a five-year-old female child, by Bendixen and Lamb (1). Bergstrom (2) reported congenital neuroblastoma with multiple skin nodules and calcification. Chandler and Norcross (4) showed calcification on the x-ray film of the chest of a boy aged six years. Bothman and Blankstein (3) found calcification along the spine in a five-year-old white girl with an adrenal tumor. Holmes and Dresser (5) report autopsy observations of calcification in adrenal neuroblastomas. Lederer (6) discovered a case roentgenologically in the left adrenal of a girl of four and a half years. Definite calcification was seen by Malisoff (7) on x-ray films showing a large left adrenal mass in a fourteen-year-old colored girl. Parsons and Platt (10) reported calcification in 2 of 6 cases of abdominal neuroblastoma. Both patients were white, one a male aged two and the other a female of six years. In a stillborn seven-month fetus studied by Potter and Parrish (11), necrosis with calcification was present in the tumor.

Startz and Abrams (12) found a globular partly calcified mass in the upper lobe of the right lung on an x-ray film of the chest of a colored child. Their report emphasizes the importance of keeping sympathoblastoma in mind in the differential diagnosis of chest tumors, more particularly when calcification is present.

One of 3 cases reported by Wolbach and Morse (13), on section of various nodules, showed necrotic tumor tissue with many small gritty areas. Wollstein (14), in a report of 9 cases of neuroblastoma, describes a tumor 18 cm. long, 11 cm. wide, and 37 and 27 cm. in circumference showing many yellow points of calcification, some so hard they grated against the knife.

Wyatt and Farber (15) presented 40 cases of neuroblastoma, with calcium deposits present in 6 instances, varying roentgenologically from fine uniform stippling in the center to irregular confluent shadows of increased density throughout the tumor.

CASE REPORT

A colored boy, aged two years, was admitted to the outpatient pediatric clinic because of a head cold, non-productive cough, and loss of appetite of several days duration. He had been subject to colds

[1] Accepted for publication in July 1948.

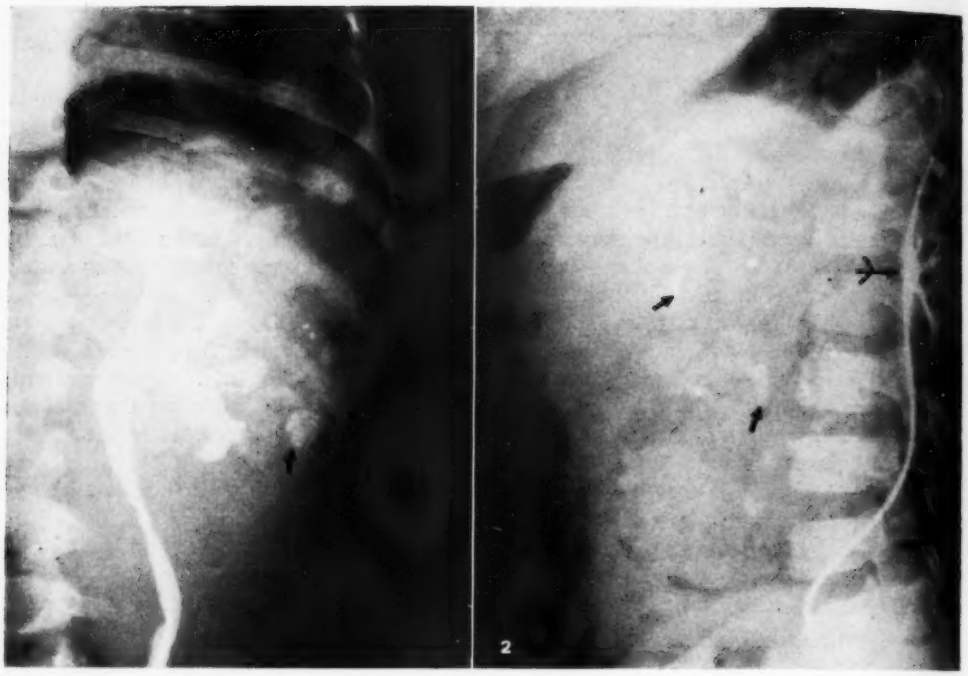

Fig. 1. Anteroposterior retrograde pyelogram of left kidney. Arrows point to calcifications in non-adrenal abdominal sympathoblastoma.

Fig. 2. Lateral retrograde pyelogram. Double arrow points to the renal pelvis, in the extreme posterior abdomen. Single arrows outline a non-adrenal abdominal sympathoblastoma anterior to the kidney.

since birth. Physical examination revealed a firm non-tender mass the size of a small grapefruit, in the left hypochondrium. The mother, when questioned, said that she had noticed this slowly growing mass since the age of four months. There had been no tenderness, pain, or discomfort.

Intravenous pyelograms with diodrast showed satisfactory filling of both renal pelves and calices. Anteroposterior and lateral views (Figs. 1 and 2) showed an oval mass 13.5 cm. in height, 7 cm. in width, and 9.5 cm. in depth, anterior to the flattened, posteriorly placed left renal pelvis and calices. Several areas of calcified deposits were noted, scattered particularly through the central portion of the mass. These were best seen in the original roentgenograms (Figs. 1 and 3). The mass was definitely toward the anterior and lower aspect of the left kidney. Fluoroscopy and films with the colon filled by barium enema showed displacement of the left side of the transverse colon anteriorly and downward by the mass. A diagnosis of sympathoblastoma was favored by the roentgen department as against Wilms' tumor, on the basis of the calcification, but the fact that the tumor was not in the adrenal brought sharp criticism of this opinion from the clinicians.

Urinary studies showed albumin 2 plus, 0–2 red blood cells and 0–4 white blood cells per high-power field. Hemoglobin was 11 gm., the red blood cell count 3,000,000, and the white cell count 12,600, with 63 per cent polymorphonuclears, 2 per cent eosinophils, 3 per cent basophils, and 32 per cent lymphocytes.

The tumor was surgically removed by an anterior transperitoneal approach. It was well encapsulated, anterior to the left kidney and adrenal. Microscopic sections reviewed by numerous pathologists showed a well developed sympathoblastoma.

Recovery was uneventful, and one year later examination, including a chest film, showed no recurrence of the tumor.

The patient was re-admitted to the hospital two years later at the age of four years. Three weeks prior to re-admission the mother had noticed a small mass the size of a quarter, movable but firm, on the anterior abdominal wall in the line of the operative scar. The liver, kidneys, and spleen were not palpable and no other masses were found.

A chest film and laparotomy showed no thoracic or intra-abdominal recurrence or metastases. The small tumor in the abdominal wall was completely excised. Microscopic examination showed it to be a benign neurofibroma. Macroscopically it measured 5.5 × 4.0 × 1.5 cm. and resembled a desmoid of the rectus muscle. Blood, urine, and serologic tests were normal.

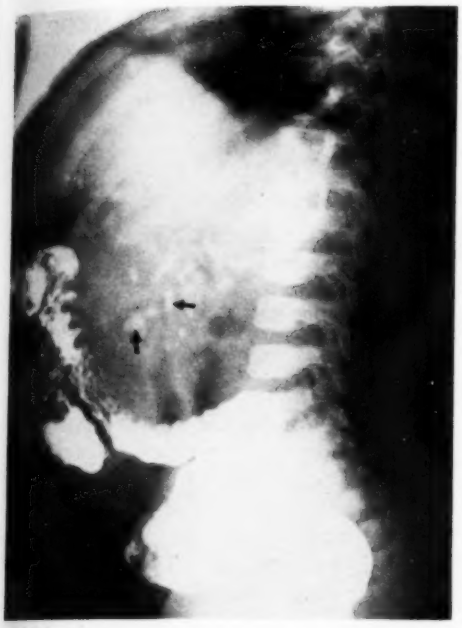

Fig. 3. Lateral film with barium in the colon, which is displaced downward and forward by sympathoblastoma. Arrows point to calcifications in the tumor.

SUMMARY

The case of a young child with calcification in a retroperitoneal non-adrenal sympathoblastoma is reported. Fifteen papers describing calcification in sympathoblastoma, both thoracic and abdominal, were found in the literature and are summarized and listed in the bibliography.

Calcification is not at all pathognomonic of sympathoblastoma, or of any other tumor, but it occurs frequently enough in the neuroblastomas of childhood to warrant their serious consideration in the differential diagnosis.

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SUMARIO

Calcificación en el Simpaticoblastoma (Neuroblastoma)

El caso comunicado de calcificación en un simpaticoblastoma retroperitoneal no suprarrenal fué en un niñito. En la literatura descubriéronse quince trabajos descriptivos de calcificación en un simpaticoblastoma, ya torácico o abdominal, que se enumeran y sumarizan en la bibliografía.

La calcificación no es en modo alguno patognomónica de simpaticoblastoma ni de ningún otro tumor, pero su frecuencia en los neuroblastomas infantiles es tal que justifica la consideración detenida de los mismos en el diagnóstico diferencial cuando se halla presente.

Observations on the Hypophyseal Area in Hypertension[1]

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THE PROBLEM OF the etiology of hypertension is a complex one, and one that is far from being solved. Although recent studies have greatly modified our views regarding the probable pathogenesis of essential hypertension, and have advanced our understanding of the problem considerably, no etiological factor has been established which will explain all cases.

Renal hypertension was induced by Goldblatt (1) in animals by clamping the renal artery, producing a renal ischemia. Renal ischemia has also been produced by numerous other devices, such as ureteral obstruction, constriction of the kidney by a cellophane membrane, partial excision of the kidney, and by experimental nephritis. The renin pressor mechanism which develops as a result of the renal ischemia is responsible for the hypertension in the experimental animal. The evidence that this mechanism is responsible for essential human hypertension is not conclusive. It may account for some cases, but it does not explain the etiology in all cases, nor does it exclude other factors as the primary cause in some and an accessory cause in others.

The view that some extrarenal factor may be responsible for the initial renal ischemia has not received much support. The part played by the glands of internal secretion has been studied by Page (2), Goldblatt (3), and others. Hypophysectomy does not prevent the development of experimental renal hypertension, and Goldblatt believes that the pituitary is not important in the mechanism of hypertension of this type. He found, however, that high blood pressure was not well maintained in the absence of the gland. Excision of both gonads, thyroid, and pancreas is also without effect on the development of this kind of hypertension. The only gland definitely implicated is the adrenal. Bilateral adrenalectomy, with consequent removal of adrenal cortical tissue, interferes with the development and maintenance of experimental renal hypertension unless substitution therapy is maintained.

It is well known, however, that tumors producing over-activity of the pituitary or the adrenal glands are responsible for the occurrence of high blood pressure and that hypofunction of these glands is characterized by hypotension. Pheochromocytoma and adrenal carcinoma are the most common lesions of the adrenal glands associated with hypertension. Tumors of the pituitary gland may play a role in the mechanism of high blood pressure, the most common being the basophile adenoma or infiltration characteristic of Cushing's syndrome. Acromegaly is often accompanied by hypertension, while Simmond's disease or atrophy of the pituitary usually leads to marked hypotension. The mechanism of these changes, however, is not clear.

Renewed interest in the role of the pituitary gland in hypertension has been stimulated by the recent work of Pendergrass, Griffith, and associates. Pendergrass, Griffith, Padis, and Barden (4) studied the effect of irradiation of the pituitary gland in patients with hypertension and found that the chance of benefit should be at least 75 per cent if the cases are selected according to the following criteria: (*a*) positive bioassay for antidiuretic hormone in serum; (*b*) a roentgen dosage of 1,000 r delivered into the hypophysis (2,000 r in air), repeated in three months if the test for antidiuretic hormone in the serum has not become negative in that time; (*c*) a negative bioassay for gonadotropic hormone in the serum at the level of 330 mouse units per 100 c.c;

[1] Accepted for publication in July 1948.

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(*d*) a normal renal function as shown by a plasma creatinine; and (*e*) good clearance of injected dye from each kidney as shown by urography. Roentgenograms of the pituitary fossa showed enlargement in 7 of 28 cases. This did not seem to bear any relationship to the result of therapy.

In 1941 Griffith, Corbit, Rutherford, and Lindauer (5) described a group of patients with high blood pressure which they believed was due to increased activity of the posterior lobe of the pituitary. The sera of these patients contained a substance capable of suppressing water diuresis in rats. It was suggested that this antidiuretic substance was the antidiuretic hormone derived from the posterior lobe of the pituitary. These patients were treated by injections of pitressin tannate, the very hormone thought to be causing the trouble, patients being selected on the same basis as for pituitary irradiation. This treatment was based on the work of Robinson and Farr (6), who in 1940 showed that after several injections of pitressin the body reacts in a manner to produce diuresis rather than antidiuresis. This paradoxical effect they explained by the possibility of the development of an antihormone.

The present study was undertaken for the purpose of ascertaining if there were any relationship between the size of the pituitary, as determined by roentgen-ray examination of the hypophyseal area, and hypertension in a given group of patients.

Roentgenograms were made of the hypophyseal areas of 100 adult male patients with hypertension at a Veterans Hospital; also a control group of 100 patients with normal blood pressure. These patients were all veterans of World War I, and their average age was about fifty years. There was no clinical evidence of pituitary disease in either group. The size of the pituitary fossa was determined by measuring the anterior posterior diameter and the depth. The lateral surface area was determined approximately by multiplying the two diameters. The results are given in Table I.

Heublein (7) recently measured the hypophyseal fossas of 100 young soldier patients in order to establish a standard, as the validity of previously reported measurements had been doubted. His average measurements were: anteroposterior diameter 10.66 mm., depth 8.30 mm. The largest fossa in his series measured 13 mm. in anteroposterior diameter and 9 mm. in depth; the smallest was 8 × 5 mm. The measurements in the normal group of the present series compare closely with Heublein's figures (Table II).

TABLE I: X-RAY MEASUREMENTS OF SELLA TURCICA

Series	A.P. Diameter	Depth	Lateral Surface Area (Approx.)
Hypertension	11.37 mm.	8.03 mm.	98.06 sq. mm.
Normal	10.27 mm.	7.51 mm.	77.47 sq. mm.

TABLE II: COMPARISON OF NORMAL VALUES

Series	Number of Cases	A.P. Diameter	Depth
Present	100	10.27 mm.	7.51 mm.
Heublein's	100	10.66 mm.	8.30 mm.

Hurxthal (8) studied the area of the lateral contour of the sella by obtaining tracings on semitransparent ruled millimeter paper. The average area as determined by this method was found to be 80 to 100 square millimeters. Average measurements of the lateral contour as obtained in the present series by multiplying the anteroposterior diameter by the depth are approximately the same.

TABLE III: LATERAL SURFACE AREA OF PITUITARY GLAND (APPROXIMATE) IN RELATION TO SYSTOLIC PRESSURE

Systolic B.P.	No. of Cases	Area, sq. mm.	Systolic B.P.	No. of Cases	Area, sq. mm.
100–110	7	69.7	150–160	7	66.6
110–120	16	76.7	160–170	20	83.7
120–130	24	77.5	170–180	29	95.6
130–140	23	69.3	180–190	20	98.4
140–150	30	71.6	190–200	11	98.7
			200–210	17	99.4
			210–220	12	82.4
			220 and over	11	96.3

The values for the average anteroposterior diameter, the depth, and the lateral surface area in the group with hypertension are greater than for the normal group.

Comparison of the lateral surface areas when the cases are classified according to the degree of systolic hypertension shows that there is a tendency to an increase in the average size of the surface area with the development of the hypertension. This area tends to remain approximately within the same limits for systolic pressures from 100 to 160; for pressures of 160 to 220 or over there is an increase in the area (Table III).

Rasmussen (9), in a study of the human hypophysis, noted that the average gland is in the neighborhood of 13 mm. in transverse diameter, 10 mm. in sagittal diameter, and 6 mm. in vertical diameter; also that the female hypophysis is heavier than the male. In pregnant females and in women who have borne children, the hypophysis may be expected to be distinctly larger. Erdheim and Stumme (10) showed that there is an increase in hypophyseal weight to the 10th lunar month of pregnancy and then a rapid decline, also that repeated pregnancies result in a still larger hypophysis in many cases.

In studies of the relation of hypophyseal weight to stature, the hypophysis was found to be larger in tall men than in short men, although no such correlation was observed between adult body weight and the weight of the organ. This finding is interesting because of the influence of the functional activity of the hypophysis upon gigantism and, together with the findings of Erdheim and Stumme, may have a bearing on the relation of functional activity to the size of the hypophysis.

The average measurements of the human hypophysis made by Rasmussen are comparable to the x-ray measurements of the hypophyseal area in the series of normal cases observed in this study. However, when measurement of the hypophysis was made by weight, Rasmussen found that there may be a wide variation between the size of the sella turcica and the weight of the enclosed hypophysis. He cites, as an example, two sellae of almost the same size, though the hypophysis in one was 50 per cent greater in weight than the hypophysis in the other. The difference he attributes to the fact that the amount of surrounding connective tissue and the capacity of the intercavernous sinus vary greatly.

The results of the various measurements made in the series of cases in the present roentgen-ray study indicate that there is a tendency to an increase in the size of the hypophyseal area in the group of patients with hypertension. A large series of cases will be necessary, however, before any statistical conclusions can be drawn as to this point or as to a possible relationship of increased activity of the pituitary gland to hypertension.

SUMMARY

Measurements were made of the hypophyseal area in a group of 100 patients with hypertension and compared with those of a similar control group of patients without hypertension. A tendency toward an increase in the size of the pituitary gland in hypertension was noted.

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SUMARIO

Observaciones del Area Hipofisaria en la Hipertensión

En un grupo de 100 hipertensos hiciéronse mediciones del área de la hipófisis, comparándolas con las de un grupo semejante de testigos sin hipertensión, y notándose tendencia a aumento en el tamaño de la glándula en la hipertensión. No obstante, se necesitará una serie más numerosa de casos antes de poder sacar conclusiones estadísticas con respecto a dicho punto o al posible papel de la hiperactividad del cuerpo pituitario en la producción de hipertensión.

Venous Intravasation During Myelography[1]

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VENOUS INTRAVASATION during myelography is of rare occurrence. A single instance was observed in 575 myelographic studies made in this hospital.

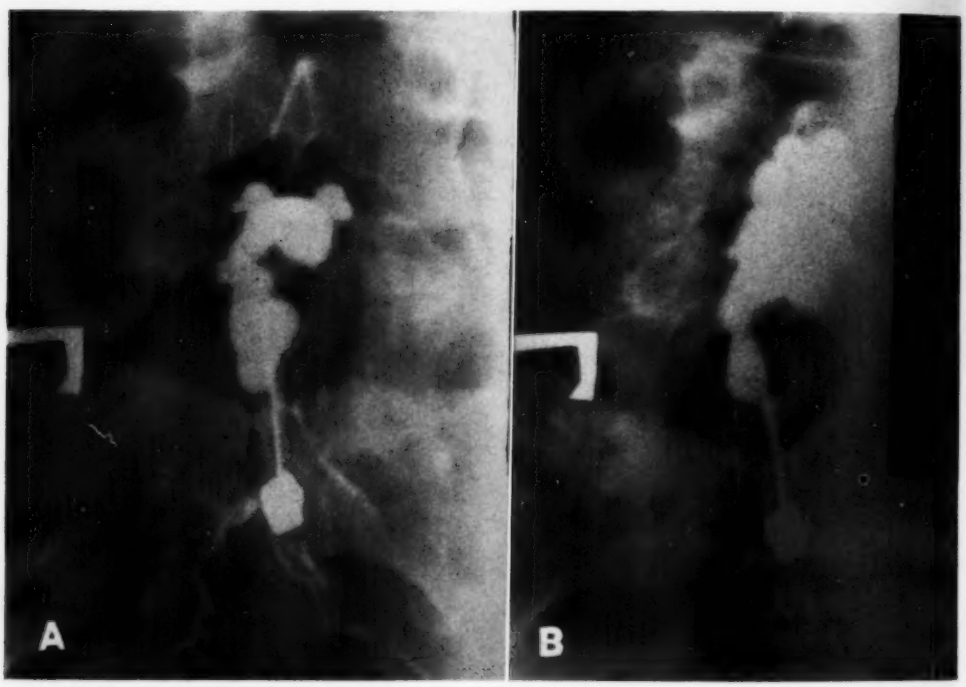

Fig. 1. A. Moderate amount of pantopaque has leaked out. The intervertebral veins are clearly shown. This film was made fifteen to twenty seconds after that in B. B. Beginning of intravasation. The large defect to the right of L-5 is demonstrated.

A white married female, aged 44, was admitted to the hospital with a history of low back pain for four years and right leg pain for two months. Four years before admission, while lifting a basket of clothes, she became conscious of something "giving way" in her back and of a dull aching pain on the right side. She went to an osteopath, who "manipulated" her back, and she was relieved. This she did several times. Two months before she was seen at the hospital, she had a cold, during which she coughed and sneezed repeatedly. At that time she suddenly had a severe pain in the back radiating down the right leg to the toes. This remained constant, and at the time of entry the patient had noticed a weakness of the right leg and numbness of the lateral part of the right foot.

The findings on physical examination were not significant. Neurological examination showed the cranial nerves to be intact. Hypesthesia was present on the lateral aspect of the right leg and foot. The Achilles reflex on the right was absent. The back flexed 30 degrees, with buttock pain on the right. Extension and lateral bending were normal.

Urinalysis was negative. The red blood cell count was 3,880,000; hemoglobin 12.1 gm., 71 per cent; white cell count 8,000, with polymorphonuclears 61 per cent and lymphocytes 39 per cent; Wassermann

[1] From the Department of Radiology, Franklin Hospital, San Francisco, Calif. Accepted for publication in July 1948.
[2] Clinical Instructor in Radiology, University of California Medical School.

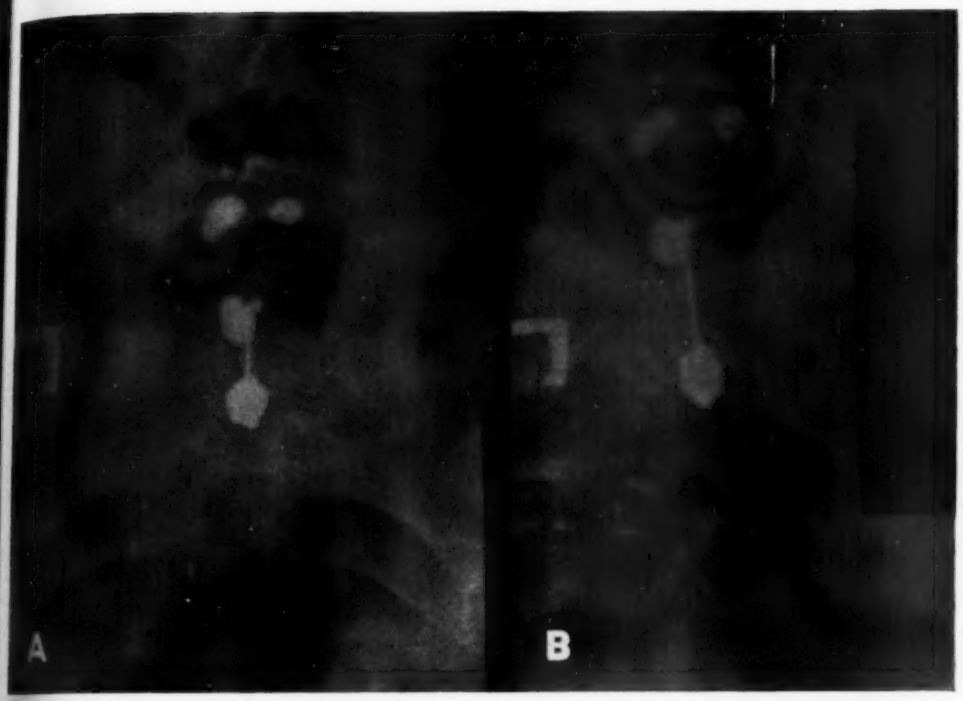

Fig. 2. A. Film obtained twenty to thirty seconds after B. B. The pantopaque has been almost completely removed by the veins. The last traces are leaving the intervertebral veins.

and Kahn tests negative. The cerebrospinal fluid showed 5 white blood cells and 3,500 red cells; the Wassermann reaction was negative; the colloidal gold curve 0000000000.

Lumbar myelography was done. The opaque oil was injected in the fifth interspace and revealed a large filling defect on the right of L-5. The pantopaque was seen to leave the spinal canal through the venous plexus in the area, and within three minutes the greater part was gone. Fluoroscopy of the chest at the time revealed no evidence of opaque oil there, and later films of the abdomen showed no evidence of oil in the pelvis or abdomen.

The patient was operated on, and a moderate amount of adjacent lamina on the right side was rongeured away. Immediately underlying the first sacral root was a large mass consisting of nuclear material which had extruded completely through a hole in the annulus fibrosus. An incision was made into this mass of herniated material, following which it was removed in its entirety with the grasping forceps. The hole in the annulus was then enlarged, the disk space was curetted, and all available nuclear material was removed. The ligamenta flava were then removed between L-4 and L-5 on the right side, and exploration was undertaken. Normal anatomical relations existed here. Articular facets between the 4th and 5th lumbar segments were

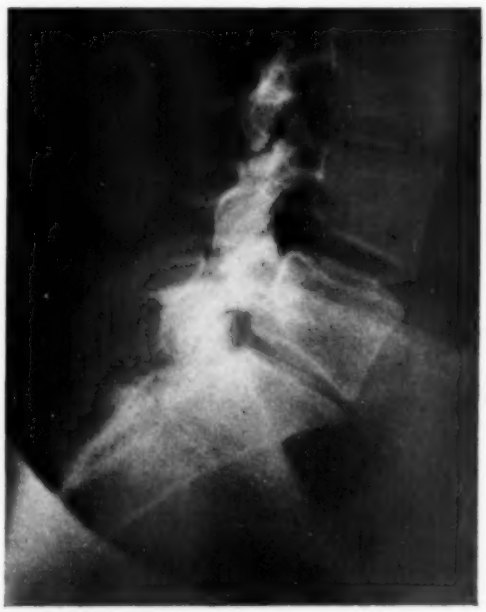

Fig. 3. Film showing narrowing of the lumbosacral disk.

cleared of their cartilage by means of a curved osteotome and curette, and the bony surfaces were freshened. The spinous processes of the 3rd and 4th lumbar vertebrae were removed and used as grafts, wedging the facets firmly. The bone in the sacrum was quite thin and the surgeon was unable to place the sacrum and 5th lumbar vertebra but they were found by the facet wedges. Chips of bone were placed on the left side, but the right was avoided due to the large swollen nerve root at L-5. The wound was irrigated and closed with No. 40 cotton; No. 60 cotton was used for the skin. A waterproof dressing was applied.

The postoperative course was uneventful, and the patient was dismissed from the hospital nineteen days after surgery, wearing a back brace. She was completely free of pain, and sensation had returned.

DISCUSSION

The intravasation of the intervertebral veins in this case occurred along the course of the puncture hole of the needle. The internal vertebral venous network is drained by a series of intervertebral veins which accompany the nerves through the intervertebral foramina. These intervertebral veins open externally into the lumbar veins in the lumbar region and into the lateral sacral veins in the sacral region. Figures 1 and 2 show the drainage through the intervertebral veins, most likely emptying into the lateral sacral veins. The lateral sacral veins drain into the ascending lumbar veins and thence into the inferior vena cava.

As was noticed in the laboratory study of the spinal fluid, the tap was bloody, but the fluid later appeared clear, and at the time of the injection of the pantopaque it was thought that there was no evidence of blood. Fluoroscopic examination of the chest at the time that the opaque oil was being absorbed into the venous system showed no evidence of it filtering out into the lung. The patient suffered no ill effects and no reaction was noticed.

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SUMARIO

Intravasación Venosa Durante la Mielografía

El caso comunicado es de intravasación en las venas intervertebrales en el curso de una mielografía pantopaca. La intravasación ocurrió a lo largo del trayecto del agujero de la punción por la aguja. El examen fluoroscópico del tórax en el momento en que se absorbía el aceite opaco en el sistema venoso no reveló signos de infiltración en los pulmones. El enfermo no experimentó efectos adversos.

Multiple Venous Thrombosis and Visceral Carcinoma

A Case Report[1]

ARTHUR W. PRYDE, M.D.

SECONDARY manifestations of primary disease elsewhere in the body are frequent. One of the less commonly recognized of these is multiple venous thrombosis associated with visceral carcinoma. In an excellent article, Sproul (4) reviews the findings in 4,258 consecutive autopsies with particular reference to venous thrombosis. He found that carcinoma was the most common cause of thrombosis of veins of the neck, abdomen, pelvis, and extremities. Carcinoma of the body and tail of the pancreas was the most common primary lesion, with carcinoma of the stomach and lung next in order but appreciably less in frequency. Of the carcinomas of the body or tail of the pancreas, 31.3 per cent had associated widespread venous thrombosis. Except in one case, neither inflammation nor invasion of vessels by tumor tissue could be found as a cause of the thrombosis.

Haward (2), in a review of 2,903 necropsies, found 70 cases of fatal venous thrombosis. Middle ear disease was first among the primary conditions, with 14 cases, and cancer of various organs was second, with 12 instances. Thomson (5) reports 2 cases, one associated with cancer of the pancreas and one of unknown origin, and James and Matheson (3) describe 2 cases, associated, respectively, with carcinoma of the stomach and of the lung.

Cooper and Barker (1) state that the thrombosis associated with cancer is characterized by relatively little inflammation, which aids in distinguishing it from recurrent idiopathic thrombophlebitis. This clinical differential point also carries over to the microscopic findings in biopsies of affected veins.

The association of multiple venous thrombosis and visceral carcinoma is not new. Trousseau (6) as early as 1865 placed much emphasis upon it and described several cases, of which the following is more or less characteristic.

"Some years ago one of the professors of the Faculty of Medicine had symptoms of simple ulcer of the stomach. Several physicians had been consulted; and as they found no tumor in the region of the stomach, they were disposed to regard the vomiting as symptomatic of simple ulcer. Soon after this, I learned that the professor had phlegmasia, whereupon I unhesitatingly declared that he would sink under advancing cancerous disease; the rapid progress and fatal issue of the case proved my diagnosis to be correct."

Trousseau further states:

"So great, in my opinion, is the semeiotic value of phlegmasia in the cancerous cachexia, that I regard this phlegmasia as a sign of the cancerous diathesis as certain as sanguinolent effusion into the serous cavities.

"In the cachexiae, as I have told you, there exists a special crasis of the blood, which, irrespective of inflammation, favors intravenous coagulation."

In the case to be reported here, the primary lesion was a pulmonary carcinoma of alveolar type.

CASE REPORT

A 41-year-old white male who worked as a carder of wool had been well until Christmas of 1946, when pain developed in the left calf, followed by swelling of the left foot and ankle, with recovery in two weeks. One month later, Jan. 28, 1947, he had a sudden sharp pain in the left lower chest, followed by cough and some hemoptysis, which was attributed to a pulmonary infarct. On Feb. 9, swelling of the neck occurred and two days later swelling of the right shoulder and arm, with a palpable "cord" on the lateral surface of the right arm. Full recovery ensued in two weeks. The patient then returned to work and felt well. About the middle of March, his

[1] From the Department of Radiology, Hospital of the University of Pennsylvania, Philadelphia, Penna. Accepted for publication in July 1948.

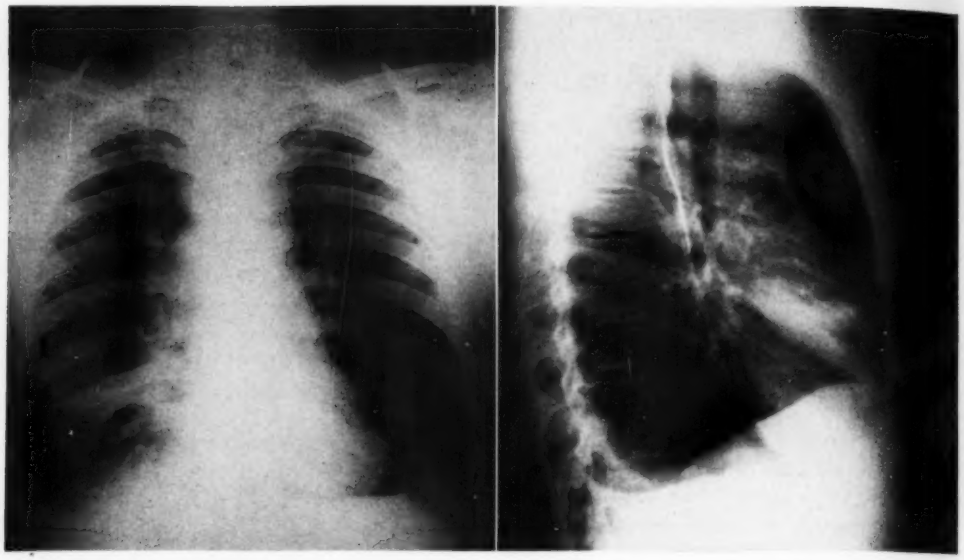

Fig. 1. Admission chest roentgenograms of a patient with multiple venous thrombosis, found at autopsy to have a carcinoma of the left upper lobe of the lung. Note the widening of the upper mediastinum on the right, with a density extending downward, laterally, and forward. The nature of this density, which shifted in position (Fig. 3A), was never explained even at autopsy. It may have been due to atelectasis.

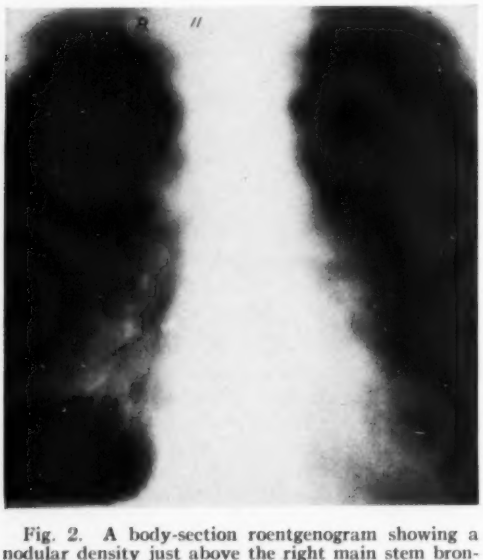

Fig. 2. A body-section roentgenogram showing a nodular density just above the right main stem bronchus, which was found at autopsy to represent enlarged nodes with a necrotic center. The roentgenogram suggests narrowing of the bronchus to the lower lobe, but at autopsy no abnormality was found.

face and neck began to show progressive swelling, soon accompanied by purplish discoloration of the lateral chest wall bilaterally.

The patient was admitted to the University of Pennsylvania Hospital on April 2, 1947. At that time, his face, neck, and each entire arm showed a non-pitting brawny swelling of the soft tissues. Veins of the involved region were dilated, including the retinal veins. The symptoms were those due to the swelling, namely, difficulty in swallowing, tightness in the throat, and a stuffy nose.

The venous pressure in both arms was considerably elevated; the arterial pressure, on the other hand, was normal and equal bilaterally. Blood Kolmer and Kline tests were negative; the tuberculin reaction was 1 plus. Routine blood counts were normal except for a persistently elevated eosinophil count of from 10 to 34 per cent. The sedimentation rate was elevated. The urine was negative except for a transient pyuria. Routine blood chemistry studies, sputum tests, urography, and roentgen examination of the gastro-intestinal tract gave normal findings.

Roentgenograms of the chest on admission (Fig. 1) showed a widening of the superior mediastinum and an area of density extending from the hilus into the lower right lung field. During the subsequent three months these changes showed only slight increase in degree, accompanied by a slight to moderate bilateral pleural effusion, mainly on the right. Laboratory study of this pleural fluid was essentially negative.

Body-section films (Fig. 2) showed a nodular density above the right main stem bronchus, which was believed to represent a tumor.

Bronchoscopy showed no bronchial narrowing or intrinsic lesion. Study of aspirated bronchial secre-

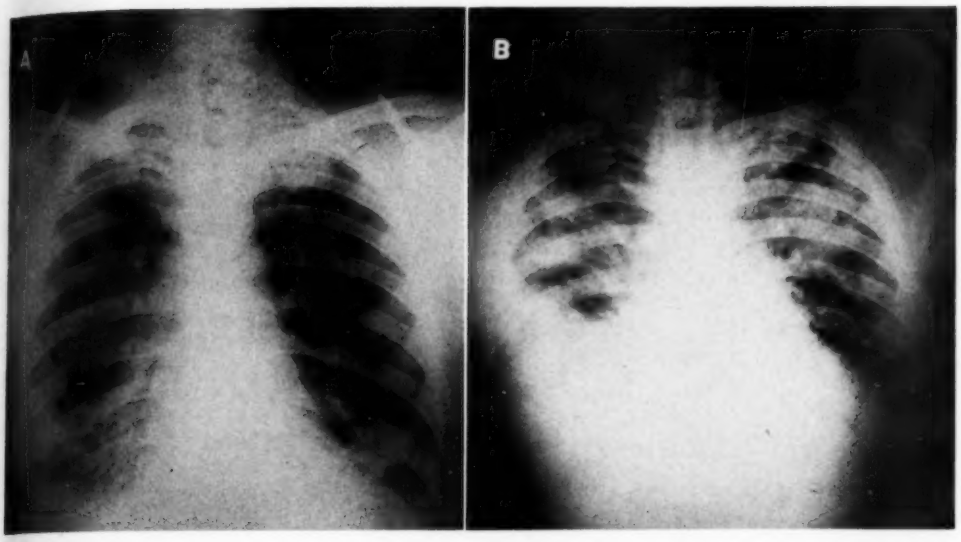

Fig. 3. A. Roentgenogram made eighteen days before death. Compared with the appearance in Fig. 1 there has been peripheral migration of the density in the right lower lung field. A shadow has appeared in the left apex with a questionable rarefied center, found at autopsy to be an alveolar carcinoma with central cavitation. B. Roentgenogram made one day before death, showing bilateral pleural effusion with extensive parenchymal changes, found at autopsy to be due to edema and radiation reaction. The tumor in the left apex has enlarged.

tion with the Papanicolaou stain was negative for tumor cells. A biopsy of several enlarged matted left axillary nodes showed non-specific lymphadenitis.

After bed rest, heparin, and dicumarol therapy, the swelling of the face, neck, and arms lessened over a period of several weeks, although there developed a tender thrombosis of the left popliteal vein. After study of the case, it was believed by some that, in addition to the apparent multiple venous thrombi, a tumor in the mediastinal region was probable. Roentgen therapy (200 kv.p.) was given through multiple portals. Approximately a 2,500 r tissue dose was delivered to the superior mediastinum and also to each supraclavicular fossa. These treatments covered a period of two months and were followed by questionable improvement.

In July, after three months hospitalization, the patient was discharged, somewhat improved, only to be readmitted three weeks later with a tender thrombosed vein in the right popliteal space.

Chest roentgenograms on readmission (Fig. 3A) showed the parenchymal shadow in the right lower lung field to lie more peripherally; a small amount of fluid was present in each costophrenic sulcus, and new areas of parenchymal density had appeared in the left apical and basal regions. Shortly after admission there was a rise of temperature to 102 degrees. Fever persisted, and a month later the swelling of the face, neck, and arms increased rapidly, accompanied by paroxysms of acute dyspnea. Hematemesis developed and death ensued.

A roentgenogram (Fig. 3B) taken on the day before death showed considerable increase in the pleural fluid and parenchymal changes. A rarefied area in the left apical density was suggestive of a cavity.

At autopsy an alveolar-type pulmonary carcinoma was found in the left apical region, containing a cavity 4 cm. in diameter. Metastases were present in nodes from the right axilla and the root of the neck on the left. The superior vena cava contained a large canalized thrombus showing active fibroblastic proliferation and several nests of tumor cells similar to those in the lung; it extended downward and nearly occluded the orifice to the right atrium. Sections of the right internal jugular, right femoral, and popliteal veins contained thrombi which, except for those in the popliteal veins, were well organized; all showed canalization. Fibroblastic proliferation was prominent in these thrombi and inflammatory change was not present to any great extent, although numerous lymphocytes surrounded vascular channels at one point in the superior vena cava. It was difficult to classify these changes under the two classifications given by Cooper and Barker (1) differentiating between idiopathic migratory thrombophlebitis and those secondary to carcinoma. Evidence of gross inflammation of the veins was slight or absent. Sections taken from each lobe of the lung showed radiation reaction. No explanation was found for the increased density in the right lower lung field (Fig. 1). Large lymph nodes with a necrotic center formed the nodular density just above the right main stem bronchus (Fig. 2). The left pleural space contained

1,500 c.c. of straw-colored fluid and the right contained 2,500 c.c.

SUMMARY

1. The occurrence of multiple venous thrombosis in association with visceral carcinoma, especially of the tail and body of the pancreas, is not uncommon.

2. A case is reported, with autopsy findings, of a clinically indefinite carcinoma of the lung with multiple venous thrombosis.

Note: This case has been placed in the collection of the Army Institute of Pathology. Negative No. 218015.

Atomic Bomb Casualty Commission
A.P.O. 248, San Francisco, Calif.

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SUMARIO

Trombosis Venosa Múltiple y Carcinoma Visceral. Historia Clínica

Una de las menos frecuentemente reconocidas manifestaciones secundarias de una afección primaria en otra parte del cuerpo es la trombosis venosa múltiple asociada a carcinoma visceral, sobre todo del cuerpo y cola del páncreas. En el caso comunicado, la asociación era con carcinoma pulmonar de forma alveolar. Los signos clínicos del tumor eran imprecisos. Su presencia fué comprobada en la autopsia, que reveló además trombos en las venas cava superior, yugular interna derecha, femoral derecha y poplítea.

Congenital Reduplication of the Esophagus

Report of a Case[1]

RALPH C. FRANK, M.D., and LESTER W. PAUL, M.D.
Madison, Wis.

ON OCCASION, a case of such rarity is seen that its inclusion in the literature is indicated. For this reason an example of partial reduplication of the esophagus is being reported, together with a brief summary of the literature on the subject.

CASE REPORT

W. A., a 10-year-old white boy, was admitted to the State of Wisconsin General Hospital on Sept. 22, 1941, complaining of "trouble in swallowing."

The family history was negative for congenital malformations or other significant disease. In addition to the usual exanthemata, the patient, at the age of eight, had a six weeks illness characterized by moderate fever, a stiff neck, back, and legs, and severe headache, but no convulsions, twitchings, or paralysis. His physician made a diagnosis of meningitis. Recovery was complete. Physical and mental development were entirely normal.

During his fifth year the patient began to experience dysphagia, particles of food becoming lodged in his throat. At such times the particular item of food would descend no farther nor could it be regurgitated, and it was necessary for the physician to force the obstructing food into the stomach with a rubber tube. Following this procedure the patient would be asymptomatic, but until it had been performed he would be unable to swallow even water.

Such incidents occurred only once or twice a year. Occasionally the patient was able to "work it up" himself. He learned to chew his food well and to drink large amounts of fluids. A year and a half before entry, he found that vomiting induced immediately was successful in bringing up the offending food.

Following an appendectomy in August 1941, he was unable to swallow for three days and was then relieved of symptoms temporarily after vomiting a cupful of "brown and bloody" material. Early recurrence of dysphagia, however, forced him to adopt a liquid diet. For a week prior to entry he had been bothered by regurgitation and reswallowing after most meals, symptoms that had occurred rarely in previous years.

The child was bright and co-operative, well developed, and fairly well nourished, without acute symptoms. The only positive finding by physical or laboratory examination was a mild anemia (hemoglobin 75 per cent).

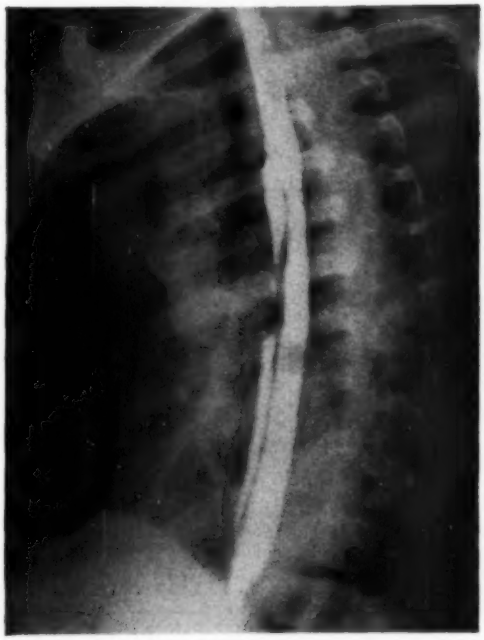

Fig. 1. Oblique view of the esophagus, September 1941, when the patient was ten years old. The two channels and their communications at either end are clearly shown. The break in the barium shadow in the smaller channel is an artefact due to incomplete filling at the time the exposure was made.

An upper gastro-intestinal series on Sept. 22, 1941, revealed a bifurcation of the mid esophagus for a distance of about 13 cm. The barium mixture descended normally to the point of bifurcation, divided, and then descended through both channels. There appeared to be a moderate predominance in function of one channel, and its lumen was somewhat greater in diameter than the other. In the lower thorax they reunited into a single structure which entered the stomach in normal fashion (Fig. 1). The stomach and duodenum were normal. Immediate gastric emptying was satisfactory.

The patient was discharged on Sept. 26, 1941. Surgery was to be considered at a later date.

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[1] From the Department of Radiology, University of Wisconsin Medical School and the State of Wisconsin General Hospital, Madison 6, Wis. Accepted for publication in August 1948.

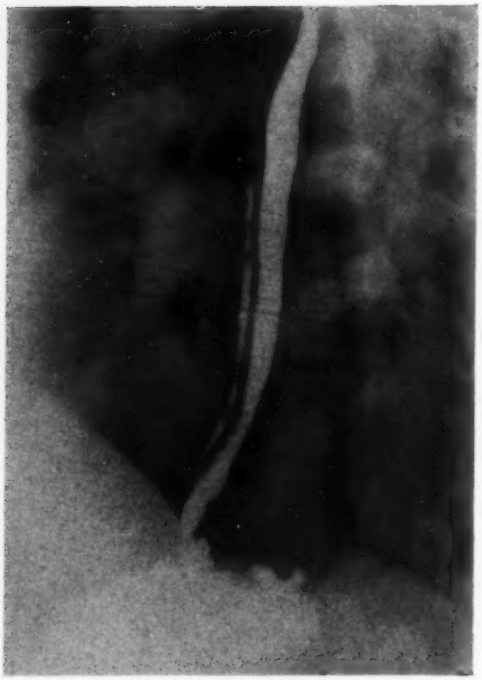

Fig. 2. Appearance of the esophagus in May 1948, approximately seven years later. There is further disparity in size between the two channels, and it was difficult to obtain roentgenograms showing all of the smaller tract completely filled at any time. It was patent throughout its length but most of the barium mixture passed through the larger tube.

Nothing further was heard of the case until May 1, 1948, when, at our request, the patient returned for re-examination. Growth and development had been normal and the only complaint was occasional mild dysphagia controlled rather easily by thorough mastication and minor attention to diet. Radiographic examination again demonstrated the esophageal bifurcation. At this time, however, there was more disparity in size between the two channels, one being noticeably larger than the other and apparently having assumed most of the burden of conveying material from the upper to the lower esophagus (Fig. 2).

COMMENT

References to doubling of the esophagus are not infrequent. Morris (7) states that it may be in part either double or absent, and Cunningham (2) lists doubling in part of its course among the chief anomalies of the organ. Vinson (9) remarks that the esophagus may be duplicated completely. Yet actual case reports of the anomaly are so infrequent that it must be considered the rarest of congenital esophageal malformations.

Information was sought from several individuals whom we thought might have had some experience with this condition. Farber (3) at the Children's Hospital in Boston has not seen a case, although congenital esophageal anomalies are frequently seen in that institution. Likewise Flory (4) of Cornell University found no record of such a case in the pathology department there, nor has Potter (8) of the Chicago Lying-In Hospital seen one.

Guthrie (6), reporting 38 esophageal anomalies found in 6,916 autopsies performed on children, mentions doubling but did not find a case of it.

Abel (1) mentions Blasius who, in 1674, in *Observata Medica Rariora* described the case of a newborn infant in whom the middle half of the esophagus was double. No obstruction was present. Abel could find no record of any similar case.

In 1933 Gjørup (5) reported a case of double esophagus and double stomach found at autopsy in a seventeen-day-old infant. The right half of the double stomach was connected to the pylorus, but the left half ended blindly in its distal portion. Two esophagi were found, one for each half of the stomach. Unfortunately the examiner failed to determine how far superiorly the reduplication extended, and it is not known whether or not it was complete.

Gjørup reviewed the literature and could find only two other reported cases, both of which he discredits. In one of these, reported by Kathes, there was an esophageal carcinoma, and the possibility of an artificially induced doubling caused by the passing of sounds could not be eliminated. The other, reported by Kopp, may have been an epithelized diverticulum produced by a foreign body.

There is no adequate embryological explanation for doubl ng or bifurcation according to Gjørup, and he feels that the best explanation lies in a partial "twinning" tendency in the embryo.

CONCLUSIONS

1. A case of congenital bifurcation of the esophagus in a ten-year-old white male is presented.

2. Although the anomaly is mentioned in several standard textbooks the present case, as far as can be determined, is only the third reported in the literature and the only one in a patient beyond infancy. Likewise it is the first in which roentgen studies have been done and the diagnosis established during life.

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SUMARIO

Reduplicación Congénita del Esófago. Observación

El caso presentado es de bifurcación congénita del esófago en un varoncito blanco de diez años.

Aunque se menciona la anomalía en varios libros de texto, el caso actual, en lo que puede determinarse, es solamente el tercero que consta en la literatura y el único observado en un enfermo, pasada la infancia. Es igualmente el primero en que se hicieran estudios roentgenológicos y en que se estableciera el diagnóstico durante la vida.

EDITORIAL

The Radiological Society of North America
The Annual Meeting

The Annual Meeting of the Radiological Society of North America will be held in Cleveland, Ohio, Dec. 4 to 9, 1949. It gives me great pleasure to invite all the members of the Society, their families, guests, and all interested physicians to attend the meeting. This year for the first time our Society will use a large convention hall, the Cleveland Public Auditorium. This will provide ample room for all meetings.

There will be adequate space for the large Scientific Exhibits and Commercial Exhibits which are being prepared.

To meet the growing and popular demand for the Refresher Courses, more courses have been added and more space for each course has been provided.

The general theme of the Scientific Program is to be the Diagnosis and Treatment of Cancer. Outstanding authorities on the various phases of cancer have been invited to address the meeting, so that a broad discussion of the subject will be presented. By presenting this type of program, the Society will substantially aid in the development of the movement for cancer control.

Cleveland offers all the attractions of a large city. The cultural and educational institutions, the parks, and the entertainment facilities of Cleveland are among the finest. For the medical visitor, there are many points of interest. Among these the Cleveland Medical Library, housed in the beautiful Allen Memorial Library Building, contains the famous Marshall collection of herbals, the Nicolaus Pol collection of early medical writings, as well as the Howard Dittrick Museum of Historical Medicine. Nearby Western Reserve University Medical School and University Hospitals are well known, especially for research in cardiovascular surgery and respiratory disease. The Cleveland Health Museum is a pioneer in public health education. The Sarah Todd McBride Museum is located in the Cleveland Clinic Foundation Building.

There are places of general interest, many of which will appeal to our lady visitors. Located in beautiful Wade Park area are the Cleveland Museum of Art, the Cleveland Garden Center, and Severance Hall, the home of the Cleveland Symphony Orchestra. Famous Nela Park, the institute of lighting research and the site of the "electric home of tomorrow," will be included in the ladies tour.

Ample hotel facilities are available, but it will be well to make reservations as early as possible.

EDGAR P. MCNAMEE, M.D.
President

REFRESHER COURSES: POST-GRADUATE INSTRUCTION

The 1949 Refresher Courses will be presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America at the Public Auditorium, Cleveland, Ohio, Dec. 4–9.

The courses will open Sunday afternoon, Dec. 4, at 3:00. Two courses will be given on Sunday, one in the afternoon, and one, the ever-popular Film-Reading Session, in the evening from 7 to 9. We have scheduled this meeting so that there will be no conflict with any other.

After Sunday, there will be seven courses daily, from 8:30 to 10 A.M. No other meetings will be scheduled for these hours, and, as far as possible, the courses have been so arranged that those interested in a particular subject may enroll in a related series.

Admission will be by ticket only, except for the Sunday sessions: Therapy Information and Film-Reading.

Non-members will be charged $3.00 for each course up to a maximum of $10.00 for the entire series. Reserve officers still on active duty and residents and fellows in radiology will be exempt from these charges.

Read the description of the courses, noting particularly the days upon which they are offered, and make your selection for each day. State your first, second, and third preferences, as in some instances the number attending each course must be limited and reservations will be made in the order in which applications are received.

Upon receipt of your application you will be notified, but your tickets will be held for you at the registration desk at the Public Auditorium. If the courses are not filled by the time of the meeting, tickets will be available at the registration desk.

It may be necessary to revise some of the courses or to change some of the instructors. We shall, however, adhere as closely as possible to the program as outlined below.

The Program Committee wishes to express its appreciation especially to Drs. Edward B. D. Neuhauser, Robert P. Barden, Paul Hodges, Ross Golden, and Juan del Regato for their assistance.

Course No. 1: Sunday, 3–5 P.M.

Therapy Information

WILLIAM HARRIS, M.D.
K. E. CORRIGAN, Ph.D.
ISADORE LAMPE, M.D.
MANUEL GARCIA, M.D.
J. A. del REGATO, M.D., Moderator

This panel will endeavor to answer questions submitted on indications and technics of radiotherapy. Questions should preferably be sent in advance of the meeting to the moderator, but will be permitted from the floor, also, as time will allow.

Course No. 2: Sunday, 7–9 P.M.

Film-Reading Session

CARROLL C. DUNDON, M.D.
L. HENRY GARLAND, M.D.
LEO G. RIGLER, M.D.
LAURENCE L. ROBBINS, M.D.
MERRILL C. SOSMAN, M.D., Moderator

This session is designed to present particular diagnostic problems and the methods of examination in selected cases for correct solution and diagnosis.

The cases this year will be selected by the Cleveland members, but any member who desires to present an especially instructive case may do so by writing directly to Carroll C. Dundon, M.D., 2065 Adelbert Road, Cleveland 6, Ohio. Cases are to be chosen on the basis of general interest and teaching value and, contrary to former years, the panel of experts will have time to study the cases before they are presented, so that we may have a diagnostic clinic of real instructive value.

Course No. 3: Monday, 8:30–10:00 A.M.

Osseous Manifestations of Systemic Diseases in Infancy and Childhood

MARTIN H. WITTENBORG, M.D.

Associate Radiologist, The Children's Medical Center of Boston; Instructor in Radiology, Harvard Medical School Boston, Mass.

The roentgenographic changes and criteria for differential diagnosis of the bone changes in systemic diseases and their influence on growth will be reviewed. Emphasis will be on the recognition of heavy metal intoxication, scurvy, rickets, renal and hepatic rickets, leukemia, the infantile anemias, xanthomatosis, and the granulomatous diseases.

Course No. 4: Monday, 8:30–10:00 A.M.

Technic and Interpretation of Roentgen Examination of the Paranasal Sinuses, Mastoids, and Upper Air Passages

BARTON R. YOUNG, M.D.

Departments of Radiology, Germantown and Temple University Hospitals Philadelphia, Penna.

The technic of examination of the nasal sinuses will be considered generally and the various views

SUNDAY, Dec. 4 3–5 P.M.	MONDAY, Dec. 5 8:30–10 A.M.	TUESDAY, Dec. 6 8:30–10 A.M.
1. **Therapy Information** William Harris, M.D. K. E. Corrigan, Ph.D. Isadore Lampe, M.D. Manuel Garcia, M.D. J. A. del Regato, M.D., Moderator	3. **Osseous Manifestations of Systemic Diseases in Infancy and Childhood** Martin H. Wittenborg, M.D.	10. **Roentgenologic Problems in Pediatric Urology** Rolfe M. Harvey, M.D.
	4. **Technic and Interpretation of Roentgen Examination of the Paranasal Sinuses, Mastoids, and Upper Air Passages** Barton R. Young, M.D.	11. **The Pneumoconioses: Clinical, Radiological, and Pathological Evaluation** Agrippa G. Robert, M.D.
	5. **Miscellaneous Skeletal Diseases** Lilian Donaldson, M.D.	12. **Arthritis of the Extremities and Infectious Diseases of Bones and Joints** L. W. Paul, M.D.
	6. **Roentgenologic Diagnosis of Diseases of the Esophagus, Stomach, and Duodenum** Richard Schatzki, M.D.	13. **Gastritis: A Correlation of the Roentgenologic and Gastroscopic Findings** Walter W. Vaughan, M.D.
7–9 P.M. 2. **Film Reading** Carroll C. Dundon, M.D. L. Henry Garland, M.D. Leo G. Rigler, M.D. Laurence L. Robbins, M.D. Merrill C. Sosman, M.D., Moderator	7. **Biological Foundations of Radiation Therapy** Isadore Lampe, M.D.	14. **Dosimetry in Radium Therapy** H. M. Parker, Ph.D.
	8. **Evaluation of Clinical Usefulness of Radioactive Isotopes** B. V. A. Low-Beer, M.D.	15. **Indications and Contraindications of Curie Therapy** Jacob R. Freid, M.D.
	9. **Treatment of Cancer of the Bladder** Milton Friedman, M.D.	16. **Radiotherapy in Ophthalmology** Clara O'Krainetz, M.D.

PRESENTATION

WEDNESDAY, Dec. 7 8:30–10 A.M.	THURSDAY, Dec. 8 8:30–10 A.M.	FRIDAY, Dec. 9 8:30–10 A.M.
17. **The Normal Gastro-Intestinal Tract in Children** John S. Bouslog, M.D.	24. **Diagnosis of Certain Chest Diseases in Infancy** John Caffey, M.D.	31. **Diagnosis of Congenital Malformations of the Heart and Great Vessels** Edward B. D. Neuhauser, M.D.
18. **Possibilities and Limitations of X-Ray Diagnosis** Leo G. Rigler, M.D.	25. **Significance of Segmental and Lobar Lesions of the Lung** Laurence L. Robbins, M.D.	32. **Radiologic Findings in Abnormal Pulmonary Function** Robert P. Barden, M.D.
19. **Diseases and Injuries of the Spine** Russell Nichols, M.D.	26. **Traumatic Lesions of Bones and Joints** C. Howard Hatcher, M.D.	33. **Neoplasm of Bone** Paul C. Hodges, M.D.
20. **Roentgenologic Diagnosis of Diseases of the Colon** Robert D. Moreton, M.D.	27. **Roentgenologic Examination of the Small Intestine (Continued Friday)** Ross Golden, M.D. Lois C. Collins, M.D.	34. **Roentgenologic Examination of the Small Intestine (Continued from Thursday)** Ross Golden, M.D. Lois C. Collins, M.D.
21. **Dosimetry in the Use of Radioactive Isotopes** Edith H. Quimby, Sc.D.	28. **Dosimetry in Roentgen Therapy** Kenneth E. Corrigan, Ph.D.	35. **Cancer of the Breast** U. V. Portmann, M.D.
22. **Indications and Contraindications for Roentgen Therapy in Cancer** William Harris, M.D.	29. **Radiotherapy of Carcinoma of the Cervix** Manuel Garcia, M.D.	36. **Radiotherapy for Neoplasms of the Oral Cavity** William E. Costolow, M.D.
23. **Radiotherapy of Scleromas, Anthrax, and Other Tropical Conditions** Manuel Riebeling, M.D.	30. **Radiotherapy of Pituitary Tumors** Franz Buschke, M.D.	37. **Radiotherapy of Cancer of the Skin** J. A. del Regato, M.D.

evaluated. Normal development from birth to adult life and developmental variations will be demonstrated, as will significant manifestations of inflammatory and neoplastic disease.

The technic employed in obtaining Bullitt, Law, Stenvers, occipital, base and Mayer views will be given and illustrated and the merits of each view discussed. The roentgen appearance of the healthy and diseased mastoid in the developmental and adult periods of life will be demonstrated.

The normal roentgen anatomy of the soft tissues of the air and food passages of the neck will be reviewed. Changes produced by faulty innervation, foreign bodies, and inflammatory and neoplastic disease will be illustrated by conventional and planigraphic roentgenograms. Fluoroscopy is an essential preliminary procedure to detect disturbances of deglutition and phonation and its value will be emphasized. The indications for planigraphy and the results obtained will be included.

Course No. 5: Monday, 8:30–10:00 A.M.

Miscellaneous Skeletal Diseases

LILIAN DONALDSON, M.D.
Woodlawn Hospital
Chicago, Ill.

Discussion and demonstration of the salient roentgen findings in such groups of diseases as the aseptic necroses and certain of those hematologic, metabolic, and congenital diseases which cause diffuse skeletal lesions, with emphasis on differential diagnosis.

Course No. 6: Monday, 8:30–10:00 A.M.

Roentgenologic Diagnosis of Diseases of the Esophagus, Stomach and Duodenum

RICHARD SCHATZKI, M.D.
Belmont, Mass.

This discussion will concern the roentgen findings in the upper gastro-intestinal tract, with special emphasis on the procedure for successful examination.

Course No. 7: Monday, 8:30–10:00 A.M.

Biological Foundations of Radiation Therapy

ISADORE LAMPE, M.D.
University of Michigan
Ann Arbor, Mich.

A general review of certain biological phenomena and concepts encountered in the interaction of radiation and living tissue. These will be discussed as they pertain to the cell and to larger cellular complexes (tissues). Certain radiobiological concepts, such as radiosensitivity, radiocurability, selective effect, and the biological effect of distribution of radiation in time, will be considered.

Course No. 8: Monday, 8:30–10:00 A.M.

Evaluation of Clinical Usefulness of Radioactive Isotopes

B. V. A. LOW-BEER, M.D.
University Hospital
San Francisco, Calif.

Dr. Low-Beer will evaluate the radioactive isotopes in both diagnosis and treatment, and will discuss the indications and contraindications for their use.

Course No. 9: Monday, 8:30–10:00 A.M.

Treatment of Cancer of the Bladder

MILTON FRIEDMAN, M.D.
New York, N. Y.

1. Nature and behavior of the disease.
2. Clinicopathological classification.
3. Reaction of the hollow viscus to various forms of treatment.
4. Radiographic appearance of bladder tumors.
5. Critical review of present methods of treatment:
   (*a*) Fulguration alone.
   (*b*) Interstitial radon implants.
   (*c*) Interstitial radium needles.
   (*d*) Total cystectomy.
   (*e*) Supervoltage irradiation.
6. The Walter Reed technic for treatment of bladder cancer.
   (*a*) Physics of dosage from a single radium source in the center of a hollow viscus.
   (*b*) Radiosensitivity classification of bladder tumors and its influence on the delivered dose.
   (*c*) Technic of treatment.
   (*d*) Management of the patient.
   (*e*) Prognosis.

Course No. 10: Tuesday, 8:30–10:00 A.M.

Roentgenologic Problems in Pediatric Urology

ROLFE M. HARVEY, M.D.
The Bryn Mawr Hospital
Bryn Mawr, Pa.

The purpose of this course is to present the roentgen appearance of the normal genito-urinary tract in infants and children, particularly with reference to the variation from the adult genito-urinary tract. Following discussion of the normal, problems peculiar to the infant genito-urinary tract, such as anomalies, congenital defects, and the characteristic tumors of childhood, will be considered in detail. Some consideration will be given to roentgen therapy in the tumor group. Embryology will be presented in sufficient detail to explain the occurrence of the various common anomalies.

Course No. 11: Tuesday, 8:30–10:00 A.M.

The Pneumoconioses: Clinical, Radiological, and Pathological Evaluation

AGRIPPA G. ROBERT, M.D.

The Baton Rouge General Hospital
Baton Rouge, La.

The changes within the lungs occurring as the result of inhaled dust will receive general discussion. The specific and non-specific pneumoconioses will be differentiated by definition and the criteria for their diagnosis detailed. Special emphasis will be placed upon the roentgenologic manifestations of the two currently recognized specific pneumoconioses, silicosis and asbestosis, but relevant clinical and pathologic findings in the pneumoconioses will be included.

The differential diagnosis of the pneumoconioses from various other pulmonary diseases which may be productive of similar roentgenographic patterns will be covered. In this portion of the discussion some special consideration will be accorded to chronic pulmonary granulomatosis of the type seen in beryllium workers.

Course No. 12: Tuesday, 8:30–10:00 A.M.

Arthritis of the Extremities and Infectious Diseases of Bones and Joints

L. W. PAUL, M.D.

University of Wisconsin
Madison, Wisc.

The first part of the course will deal mainly with the chronic lesions of the joints and periarticular tissues. Classification and terminology will be discussed briefly. The roentgen signs of these diseases will be correlated with the pathologic findings to illustrate better the mechanism of production of the alterations visualized in roentgenograms. The variations as seen in different joints and the pattern of progression of the various diseases will be given. Differential diagnosis will be included.

The second part of the course will cover the general aspects of the infections of bones and joints. Brief consideration will be given to the pathogenesis and pathology of these diseases. Early roentgen signs will be stressed. The modifying influences of chemotherapy and the antibiotics will be mentioned.

Course No. 13: Tuesday, 8:30–10:00 A.M.

Gastritis: A Correlation of the Roentgenologic and Gastroscopic Findings

WALTER W. VAUGHAN, M.D.

Watts Hospital
Durham, N. C.

The clinical significance of gastritis has been reemphasized since the introduction of the flexible gastroscope in 1932. However, roentgenologists have attempted to make an x-ray diagnosis of gastritis since shortly after Cannon first demonstrated the use of the roentgen ray in the study of gastrointestinal disease.

In a study of a large series of cases by both x-ray and gastroscopy, certain correlating factors have been observed on the x-ray examinations that, although not characteristic, are very suggestive of gastritis, such as prolonged or delayed antral systole, hypersecretion with mucoid formation deforming the mucosal folds, and a certain type of enlargement of the gastric rugae. Cases will be presented giving the roentgenologic, gastroscopic, gross and microscopic findings, with emphasis upon the correlating factors. Included in this series will be benign and malignant ulcers associated with gastritis, chronic idiopathic hypertrophic gastritis, and antral gastritis simulating gastric cancer.

Course No. 14: Tuesday, 8:30–10:00 A.M.

Dosimetry in Radium Therapy

H. M. PARKER, Ph.D.

Nucleonics Department, General Electric Co.
Richland, Wash.

The course will be based on the Paterson-Parker system of gamma-ray dosimetry under the following headings.

1. Surface Applicators
   - (*a*) Calculation of dose from a radium point source in roentgens; effect of filtration; attenuation of radiation in tissue.
   - (*b*) Calculation of dose from linear sources and rings; effect of oblique filtration.
   - (*c*) Combinations of sources to give uniform dose over a prescribed surface; practical limits of "uniformity."
   - (*d*) Extension to curved surfaces.
   - (*e*) Practical dosage charts; worked examples in therapy of superficial lesions; calculation of depth dose.
2. Cylindrical Applicators
   - (*a*) Complete cylinders; corrections for "open ends."
   - (*b*) Partial cylinders.
   - (*c*) Applications in therapy.
3. Volume Distributions
   - (*a*) Theoretical approach through fluid distributions in spheres; rind and core principle.
   - (*b*) Extension to irregular solids.
   - (*c*) Condensation to practical sources.
   - (*d*) Examples in therapy.
4. Special Combinations
   - (*a*) Line combinations applied to treatment of carcinoma of the cervix; the Manchester ovoids and intra-uterine tubes.
   - (*b*) Radium bomb therapy; isodose charts.

5. Radiography of Radium Implants
   Demonstration of the radium implant reconstructor; correction of faulty implants.
6. Limitations of Calculations
   (*a*) Non-compensating curvature.
   (*b*) Non-uniform loading of radium needles.
7. Measurement of Dose
   (*a*) Ionization methods.
   (*b*) Photographic methods.

Course No. 15: Tuesday, 8:30–10:00 A.M.

Indications and Contraindications of Curie Therapy

JACOB R. FREID, M.D.
New York, N. Y.

This course will deal with the present status of curietherapy in the treatment of cancer. The discussion will include the technics of radium therapy and the following.

Radium procedures.

Indications and contraindications to use of radium therapy.

The effect of radium therapy on the tumor and adjacent tissues.

Radium injuries.

Treatment of the more common lesions amenable to radium therapy.

Course No. 16: Tuesday, 8:30–10:00 A.M.

Radiotherapy in Ophthalmology

CLARA O'KRAINETZ, M.D.
New York, N. Y.

The course will deal with:

1. Beta irradiation (Radium D applicator) in the treatment of superficial structures of the eye. Its use in cases of corneal opacities with vascularization, pterygium, keratitis, vernal catarrh, and corneal dystrophy will be discussed.
2. The use of x-rays in the treatment of malignant lesions of the eye and adjacent structures.

Course No. 17: Wednesday, 8:30–10:00 A.M.

The Normal Gastro-Intestinal Tract in Children

JOHN S. BOUSLOG, M.D.
University of Colorado
Denver, Colo.

The developmental changes of the gastro-intestinal tract in children, both prenatal and postnatal, have been given scant consideration in the literature. The study of the anatomy of these structures in the infant depicts the radiological appearance, which is so different from the adult. The purpose of this presentation is to attempt to clarify this difference.

Course No. 18: Wednesday, 8:30–10:00 A.M.

Possibilities and Limitations of X-Ray Diagnosis

LEO G. RIGLER, M.D.
University of Minnesota

This course will concern itself with the possibilities and limitations of roentgen diagnosis with particular reference to the chest. It is important to know the relationship between the time of inception of any disease, the onset of symptoms, the first appearance of physical signs, the size of the lesion, and the first appearance of roentgen findings. Data will be presented to indicate these relationships, especially with regard to the early detection of certain intrathoracic lesions, as pulmonary edema, various pneumonias, pleural effusion, pulmonary tuberculosis, pulmonary metastases, and bronchogenic carcinoma. The importance of certain specific technical procedures in the detection of extremely small lesions in the lung will be brought out. Experimental and clinical evidence as to the minimum size lesion demonstrable roentgenographically will be presented.

Course No. 19: Wednesday, 8:30–10:00 A.M.

Diseases and Injuries of the Spine

RUSSELL NICHOLS, M.D.
University of Chicago

The speaker will discuss and illustrate the following spine lesions: rheumatoid arthritis and other forms of arthritis, fracture dislocation, neoplasms, systemic disease, tuberculosis, congenital anomalies.

Course No. 20: Wednesday, 8:30–10:00 A.M.

Roentgen Diagnosis of Diseases of the Colon

ROBERT D. MORETON, M.D.
Scott and White Clinic
Temple, Tex.

The conduct of double-contrast examinations of the large intestine will be described, with emphasis on results with different barium mixtures, preparation of patient, and technic of the examination. Some of the poor results will be shown and an attempt made to analyze the causes. Lastly, the advantages of good double-contrast examinations in both benign and malignant lesions involving the colon will be illustrated.

Course No. 21: Wednesday, 8:30–10:00 A.M.

Dosimetry in the Use of Radioactive Isotopes

EDITH H. QUIMBY, Sc.D.
Columbia University
New York, N. Y.

Problems of dosage and protection with radioactive substances are similar to those with other

REFRESHER SERIES

THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

December 4 through December 9, 1949

PUBLIC AUDITORIUM

CLEVELAND, OHIO

(Hotel Headquarters: Hotel Statler, Cleveland)

(Detach here)

To Register for the Refresher Courses

SEE INSTRUCTIONS on REVERSE SIDE AND

FILL OUT THE FOLLOWING

(*Note:* Courses are limited to members of the medical profession, including graduate students and residents in Radiology, and to radiation physicists)

(Print or type) ..... M.D.

Last Name — First Name or Initials

.....

Street Address

.....

City — State

CHECK THE FOLLOWING

Member R.S.N.A. ☐ Guest ☐

Resident or Graduate Student in Radiology at present ☐

Where.....

Reserve Officer on Active Duty at present ☐

Fill out, also, the enrollment diagram on the reverse side of this page

REFRESHER SERIES

INSTRUCTIONS FOR ENROLLMENT

Read the accompanying description of the courses and study the plan of presentation. It is important that you register early; the number admitted to each course will be limited by the seating capacity of the room. Reservations will be made in the order of the receipt of request and tickets will be held for you at the Registration desk at the Cleveland Public Auditorium, beginning December 4.

FEES

Members: No charge.

Non-Members: $3.00 for each course up to maximum of $10.00 for entire series.

Graduate students and residents in Radiology, reserve officers on active duty: No charge.

(Fees must accompany applications)

PLEASE INDICATE YOUR FIRST, SECOND AND THIRD CHOICES

	First Choice		Second Choice		Third Choice	
	Course No.	Instructor	Course No.	Instructor	Course No.	Instructor
Sunday, Dec. 4 3 P.M.						
7 P.M.						
Monday, Dec. 5						
Tuesday, Dec. 6						
Wednesday, Dec. 7						
Thursday, Dec. 8						
Friday, Dec. 9						

Prior to Nov. 25, 1949, send this order sheet to:
C. Edgar Virden, M.D., Chairman, Refresher Course Committee
320 West 47th St., Kansas City 2, Missouri

After Nov. 25, 1949, mail to:
C. Edgar Virden, M.D., c/o Radiological Society of North America
Hotel Statler, Cleveland, Ohio

(*Note:* Your tickets will not be mailed to you but will be given to you when you register for the meeting.)

types of radiation. In therapy, an adequate amount of energy must be delivered to diseased tissues without damaging normal ones. In diagnostic procedures, total dosage must be kept at safely low levels.

It is not possible to make satisfactory measurements of these doses by means of ionization chambers and phantoms, because of the uneven deposition of the isotopes in different cells, or even different parts of cells. However, when the physical factors of half life and average energy and the physiological factors of uptake and excretion are known, it is possible, in some cases at least, to make satisfactory estimates of tissue dosage.

Basic formulae for β- and γ-ray emitters will be developed, and the effect of relative concentrations and of biological eliminations discussed. A formula will be derived for determining the tracer dose of any element which will keep whole body or local irradiation within permissible levels. Extensions of the dosage formulae to apply to personnel protection will be considered briefly.

Course No. 22: Wednesday, 8:30–10:00 A.M.

Indications and Contraindications for Roentgen Therapy in Cancer

WILLIAM HARRIS, M.D.
Mt. Sinai Hospital, New York, N. Y.

The indiscriminate use of roentgen rays has, in many instances, cast a shadow of doubt regarding the efficacy of this agent. By the same virtue, lack of knowledge or the improper use of x-rays has failed to offer relief to patients who might either be cured or receive palliation in conditions which cannot be treated as successfully by other methods.

It is the purpose of this course to indicate where roentgen therapy may be employed beneficially and where it is contraindicated.

The various anatomical systems in both benign and neoplastic diseases will be discussed.

Course No. 23: Wednesday, 8:30–10:00 A.M.

Radiotherapy of Scleromas, Anthrax, and Other Tropical Conditions

MANUEL RIEBELING, M.D.
Guadalajara, Jalisco, Mexico

This course will consider the treatment of a variety of conditions in which radiotherapy has been found of value. An analysis of results and details of technic will be presented.

Course No. 24: Thursday, 8:30–10:00 A.M.

Diagnosis of Certain Chest Diseases in Infancy

JOHN CAFFEY, M.D.
The Presbyterian Hospital, New York

This course will cover abnormal shadows in the respiratory tract, including those cast by:

1. The soft tissues of the thoracic wall.
2. The diaphragm.
3. Loculated pleural exudate and loculated pyopneumothorax.
4. Bronchiectasis.
5. Loculated obstructive emphysema.
6. The thymus and mediastinal neoplasms.

Course No. 25: Thursday, 8:30–10:00 A.M.

Significance of Segmental and Lobar Lesions of the Lung

LAURENCE L. ROBBINS, M.D.
Massachusetts General Hospital, Boston

This course will include a brief review of the anatomy of the lung and a discussion of the roentgen appearance of the gross anatomy and gross pathology of certain common segmental and lobar lesions. The significance of some of the shadows seen in collapse or consolidation of various segments and lobes will be stressed.

Course No. 26: Thursday, 8:30–10:00 A.M.

Traumatic Lesions of Bones and Joints

C. HOWARD HATCHER, M.D.
University of Chicago

In addition to the usual and the rare fractures and dislocations, Dr. Hatcher will consider such forms of trauma as irradiation and interference with blood supply. Lantern slides of roentgenograms, tissue sections, and photographs of gross specimens.

Course No. 27: Thursday, 8:30–10:00 A.M.

Roentgenologic Examination of the Small Intestine

ROSS GOLDEN, M.D.
LOIS C. COLLINS, M.D.
Presbyterian Hospital
New York, N. Y.

Discussion of the anatomy, physiology, and psychosomatic manifestations of diseases of the small intestine, including diseases of the mesentery, nutritional disorders, other conditions involving damage to the intramural nervous system, and neoplasms and inflammations.

(*This course is continued Friday, Course No. 34*)

Course No. 28: Thursday, 8:30–10:00 A.M.

Dosimetry in Roentgen Therapy

KENNETH E. CORRIGAN, Ph.D.
Director, Research Division, Harper Hospital
Detroit, Mich.

I. Dosimetry below 500 kv.
   A. Measurement of dosage in air:
      1. Roentgen unit.

2. Mechanism of absorption of radiation by air.
3. Primary and secondary ionization.
4. Energy relationships.

B. Surface dosage:
1. Back-scatter.
2. Mechanism of back-scatter.
(*a*) Saturation backing.
(*b*) Area.
3. Variation of back-scatter with wave length

C. Depth dose:
1. Forward scatter.
2. Secondary equilibrium level.
3. Quality change of radiation with depth and area.

D. Tissue dose:
1. In roentgens.
2. In energy units.

II. Dosimetry above 500 kv.

A. Radiation units at high energies.
1. Nature and distribution of high-energy secondaries.
2. Scattering effects at high energies.
3. Pair formation and nuclear phenomena.
4. Present status of units of dosage at high energies.

Course No. 29: Thursday, 8:30–10:00 A.M.

Radiotherapy of Carcinoma of the Cervix

MANUEL GARCIA, M.D.
Charity Hospital
New Orleans, La.

The essential requirements of an adequate plan of irradiation for carcinoma of the cervix will be presented, together with an analysis of the variables concerned. An evaluation of the effective dosage will be made, and a method of delivering predetermined tissue dosage will be discussed. The reactions, complications, and sequels of treatment will be considered.

Course No. 30: Thursday, 8:30–10:00 A.M.

Radiotherapy of Pituitary Tumors

FRANZ BUSCHKE, M.D.
Tumor Institute of Swedish Hospital
Seattle, Wash.

Roentgen therapy is now accepted by leading neurosurgeons as the primary procedure of choice in the treatment of all three types of pituitary adenomas, with the exception of certain specific situations. In this course, differential diagnosis, indications for radiation therapy *versus* surgery, and treatment technic will be discussed, with particular emphasis on the discussion of the single course massive treatment technic *versus* multiple courses with small doses. Results as well as reasons for failures will be considered in detail.

Course No. 31: Friday, 8:30–10:00 A.M.

Diagnosis of Congenital Malformations of the Heart and Great Vessels

EDWARD B. D. NEUHAUSER, M.D.
Radiologist, The Children's Medical Center of Boston; Associate in Radiology, Harvard Medical School
Boston, Mass.

An attempt will be made to present a rational approach to the diagnosis of congenital heart malformations and abnormalities of the great vessels. Particular emphasis will be placed on the diagnosis of those lesions which are at present amenable to surgery, with a review of the differential diagnosis in each instance. An attempt will be made to group the lesions on a broad physiological basis, so that the radiologist may offer information without in all instances making an exact anatomical diagnosis.

Course No. 32: Friday, 8:30–10:00 A.M.

Radiologic Findings in Abnormal Pulmonary Function

ROBERT P. BARDEN, M.D.
University of Pennsylvania
Philadelphia, Penna.

An attempt will be made to demonstrate the possibility of interpreting physiologic abnormalities from radiologic examination. With the increase in knowledge of pulmonary function and rapid expansion of pulmonary surgery, anatomical diagnoses of chest conditions should no longer be the sole aim of radiologists. Information gained from pulmonary function studies will be correlated with roentgenograms in order to show how some qualitative information regarding function may be obtained where detailed physiological tests are not available. The concept of pulmonary insufficiency will be illustrated by examples of conditions which affect the peripheral vessels of the lung, and secondly by diseases resulting in abnormal ventilation of the lung, especially emphysema.

Course No. 33: Friday, 8:30–10:00 A.M.

Neoplasm of Bone

PAUL C. HODGES, M.D.
University of Chicago
Chicago, Ill.

By means of lantern slides of roentgenograms, specimens, and tissue, the commoner problems in the x-ray diagnosis of neoplasm of bones and joints will be illustrated. The scope and limitations of x-ray differentiation between neoplasm and a non-neoplasm and between malignant neoplasm and benign neoplasm will be discussed. A classification of primary bone neoplasm will be presented.

Course No. 34: Friday, 8:30–10:00 A.M.

Roentgenologic Examination of the Small Intestine

ROSS GOLDEN, M.D.
LOIS C. COLLINS, M.D.
Presbyterian Hospital
New York, N. Y.

(*Continued from Thursday, Course No. 27*)

Course No. 35: Friday, 8:30–10:00 A.M.

Cancer of the Breast

U. V. PORTMANN, M.D.
Cleveland Clinic
Cleveland, Ohio

The indications and limitations of surgical and radiological procedures for cancer of the breast will be discussed on the basis of a classification which includes clinical and pathological manifestations of extent of involvement. Criteria of incurability also will be discussed and illustrated by lantern slide photographs of patients presenting these signs. Technics for postoperative roentgen therapy and for treatment of incurable cases will be described.

Course No. 36: Friday, 8:30–10:00 A.M.

Radiotherapy for Neoplasms of the Oral Cavity

WILLIAM E. COSTOLOW, M.D.
Los Angeles Tumor Institute
Los Angeles, Calif.

This course will deal with the use of roentgen rays and radium in the treatment of benign and malignant neoplasms of the oral cavity. The diagnosis of these lesions will be considered. Peroral and external technics of radiotherapy will be discussed.

Course No. 37: Friday, 8:30–10:00 A.M.

Radiotherapy of Cancer of the Skin

J. A. del REGATO, M.D.
Penrose Cancer Hospital
Colorado Springs, Colo.

This course will present the problem of treatment of cancer of the skin in its different locations. The variations of technic of treatment which are necessary for the control of these tumors as well as for the attainment of optimum esthetic results will be considered.

The Cleveland Museum of Art

WASHINGTON STATE RADIOLOGICAL SOCIETY

The newly elected officers of the Washington State Radiological Society for 1949–50 are: President, Dr. Bernard Harrington of Tacoma; Secretary-Treasurer, Dr. John H. Walker, 1115 Terry Ave., Seattle. Meetings continue to be held on the fourth Monday of each month, October through May, at the College Club, Seattle.

FILIAL DEL LITORAL DE LA SOCIEDAD ARGENTINA DE RADIOLOGIA

There has recently been established in Rosario, Argentina, a branch of the Argentine Radiological Society, to be known as Filial del Litoral de la Sociedad Argentina de Radiologia, including the provinces of Santa Fe, Entre Rios, and Corrientes, and the territories of Chaco, Formosa, and Misiones. Scientific meetings will be held on the second Wednesday of each month at 663 Italia St., Rosario. The President of the new organization is Dr. Francisco P. Cifarelli.

CONTINUATION COURSE IN PEDIATRIC ROENTGENOLOGY

The University of Minnesota announces a continuation course in Pediatric Roentgenology, Oct. 31 through Nov. 5, 1949. The course, which will be presented at the Center for Continuation Study, is intended for radiologists and pediatricians. The material to be presented will include the basic medical sciences, clinical medicine, and diagnostic roentgenology as it pertains to general and special problems in the field of childhood diseases. Presentation will be by means of lectures, clinics, conferences, and round-table discussions.

Distinguished visiting physicians who will participate as members of the faculty for the course include Dr. John Caffey, Babies Hospital, Columbia University Medical Center; Dr. Edward B. D. Neuhauser, Children's Hospital, Boston; Dr. Edith Potter, University of Chicago; and Dr. Frederic N. Silverman, Children's Hospital, Cincinnati. The remainder of the faculty for the course will be made up of clinical and full-time members of the staff of the University of Minnesota Medical School and the Mayo Foundation.

DISTRIBUTION PROGRAM FOR CYCLOTRON-PRODUCED ISOTOPES

The Atomic Energy Commission has announced the initiation of a program for the production and distribution of certain cyclotron-produced radioisotopes. Acting upon the recommendations of the National Research Council, the Commission has developed a co-operative program under which isotopes produced at several cyclotron laboratories will be made available to research workers. The program will supplement the present distribution of reactor-produced radioisotopes which has been in effect since August 1946.

Only those cyclotron-produced isotopes having half-lives of more than 30 days will be distributed initially. Included in these valuable research tools are 43-day beryllium 7, 3-year sodium 22, 46-day iron 59 (free of Fe 55), 270-day cobalt 57, 250-day zinc 65, 90-day arsenic 73, and 56-day iodine 125. Other cyclotron-produced radioisotopes of significant value as tools of research may be added at a later date.

Cyclotron-produced radioisotopes, because of the method of their manufacture, are considerably more expensive than reactor-produced isotopes, and in order to price them at a level which will make them available to most research institutions it will be necessary for the Commission to subsidize the program to a certain extent. These isotopes, like the reactor-produced radioisotopes now distributed by the Commission, will be made available free of all production charges for cancer research.

The distribution of materials produced under this program will be limited to institutions and organizations within the United States and its territories and possessions. Cyclotron-produced isotopes are more readily available abroad than reactor-produced isotopes since cyclotrons are in operation in many countries.

The Isotopes Division (Oak Ridge Operations, Oak Ridge, Tenn.) is prepared to accept applications for these materials on "Application for Radioisotope Procurement" Form AEC-313. Further details are contained in *Isotopes Division Circular E-45.*

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

RADIOLOGIC EXPLORATION OF THE BRONCHUS. By S. DI RIENZO, M.D., Assistant Professor of Radiology and Physiotherapy, Chief of the Radiology Department of the Institute of Cancer, The University of Córdoba, Argentina. Translated by Tomas A. Hughes, M.D., with a Foreword by Richard H. Overholt, M.D. A volume of 332 pages, with 466 illustrations. Published by Charles C Thomas, Springfield, Ill., 1949. Price $10.75.

OTO-RHINO-LARYNGOLOGIE IM KINDESALTER, EINSCHLIESSLICH DER ENDOSKOPIE. By Dr. ELEMER JOSEF JENTS, with a contribution by Dr. GOTTFRIED ARNOLD "Störungen der Stimme und Sprache" and by Dr. ERNST G. MAYER "Oto-Rhino-Laryngologische Röntgenologie des Kindes." A volume of 326 pages, with 43 illustrations. Published by Wilhelm Maudrich, Vienna, 1949. Price $9.60.

ATLAS OF ROENTGENOGRAPHIC POSITIONS. By VINTA MERRILL, while Educational Director, Picker X-Ray Corporation. In two volumes, 664 pages, with numerous illustrations. Published by C. V. Mosby Co., St. Louis, 1949. Price $30.00.

CONFRONTATIONS RADIO-ANATOMO-CLINIQUES. Published under the direction of M. CHIRAY, R. A. GUTMANN, and J. SÉNÉQUE. Fascicule III. A volume of 80 pages, with 150 illustrations. Published by Masson & Cie, Editeurs, Paris, 1949. Price 1,000 fr.

Book Reviews

CLINICAL RADIATION THERAPY. By IRA I. KAPLAN, M.D., F.A.C.R., Clinical Professor of Radiology, New York University Medical College; Attending Radiation Therapist, Beth-David Hospital, New York; Director, Radiation Therapy Department, Bellevue Hospital, New York. Second Edition. A volume of 844 pages, with 614 illustrations. Published by Paul B. Hoeber, Inc., New York, 1949. Price $15.00.

Clinical Radiation Therapy, a revision of a work originally published in 1937, is a text of convenient size which will serve admirably as a source of ready reference for superficial and deep therapy technics and for the use of radium and radon. Supervoltage technics are omitted. Kaplan is a strong advocate of radium, which should please those who deplore the decline in its general use.

The prevalent practice of indicating dosage in terms of air-dose is followed for the most part, since a plan so designated is easily reproduced. Technical details are complete in each instance, with quality of radiation, number, size-range and shape of ports, F.S.D., daily dose, number and rhythm of treatments. Valuable instructions in general management of the patient are added.

The organization of the text resembles the original: a brief historical introduction, a concise critical section on physics with adequate coverage of isotopes, and then a section on general principles, followed by chapters on specific applications, each with headings and subheadings facilitating rapid reference. The first of these chapters deals with skin conditions. Diseases of the ear, nose, and throat are covered at length, and eye diseases are discussed separately. The treatment of chest conditions is fully described, including bronchiectasis, pertussis, and unexplained chronic cough in children. A chapter is devoted to inflammatory and rheumatic disorders. The chapter on the breast is lengthy, taking up the controversial issues. Rectal carcinoma is emphasized under gastro-intestinal diseases. Treatment in gynecologic disorders is well handled, with great attention to detail in radium procedures. Separate chapters are devoted to urologic and neurologic diseases, to bone conditions, to soft-tissue sarcomas, to blood dyscrasias, to lymphoblastomata, and to reticulo-endothelial diseases. The book concludes with two short chapters on complications and injuries and on relation of trauma to cancer.

In the discussion of individual disorders, pathology, diagnosis, and treatment are separately covered, though the text remains brief. The book is never tedious, often provocative. Illustrations are good, and the indexing excellent. The text should prove popular.

REGIONAL ILEITIS. By BURRILL B. CROHN, M.D., Consulting Gastroenterologist, Mount Sinai Hospital, New York. A volume of 230 pages, with 74 illustrations. Published by Grune & Stratton, New York, 1949. Price $5.50.

Regional Ileitis is a timely, carefully written text, well illustrated and documented. Internists, gastroenterologists, and surgeons will profit by its study. The work is based on observations on 298 private patients examined, treated, and followed over a period of sixteen to eighteen years. Four groups are considered: regional ileitis, the chronic form, represented by 222 cases; acute ileitis, 16 cases; ileojejunitis, 38 cases; combined cases, *i.e.*, ileitis with involvement of some segment of the large bowel, 22 cases. These are all types of regional or cicatrizing enteritis with common pathogenesis and pathology, and mixed forms are not unusual. Each group, however, has identifying characteristics, and its own individual treatment and prognosis.

The greater part of the book is given over to the chronic form of regional ileitis. The etiology, pathology, clinical features, treatment, and prognosis are discussed in detail. The chapter on fistula, the most common clinical feature, and the chapter on complications, are concise and well illustrated. The great importance of radiology in diagnosis and in the demonstration of the "skip-lesions" and skipped areas of normal bowel is stressed, along with differential diagnosis by means of roentgen examination. Medical treatment is outlined and surgical aspects are discussed.

One chapter is devoted to acute regional ileitis. The relationship between this condition and chronic regional ileitis is discussed and it is concluded that they probably represent different stages of the same disease. The all-important differential diagnosis

between this condition and acute appendicitis is considered. Choices of surgical procedures, if the abdomen is opened, are outlined.

The jejunum may be involved either as an extension from the ileum or independently. The nutritional, growth and development problems of ileojejunitis are presented. Results of resection of large portions of the small intestine are described.

A final chapter deals with ileocolitis. Ileitis and non-specific colitis are probably members of the same family. The disease may jump the ileocecal valve. This form of colitis is usually segmental, and the rectum is spared. The parenthood of the combined form seems to rest in the terminal ileum. Medical and surgical treatments are described.

An extensive bibliography is appended.

MALIGNANT DISEASE AND ITS TREATMENT BY RADIUM. By SIR STANFORD CADE, K.B.E., C.B., F.R.C.S., M.R.C.P., Surgeon, Westminster Hospital, Mount Vernon Hospital and Radium Institute; Lecturer in Surgery, Westminster Hospital Medical School and formerly Examiner in Surgery, University of London; Member of the Court of Examiners, late Hunterian Professor and Arris and Gale Lecturer, Royal College of Surgeons of England; Member of the National Radium Commission and Trust; Consultant in Surgery to the Royal Air Force. With a foreword by SIR ERNEST ROCK CARLING, F.R.C.P., F.R.C.S., F.F.R., Consulting Surgeon and Vice-President, Westminster Hospital. Second Edition, Volume II. A volume of 430 pages, with 205 illustrations and 66 tables. Published by Williams & Wilkins Co., Baltimore, 1949. Price $12.50.

In the second volume of the projected four-volume second edition of Sir Stanford Cade's *Malignant Disease and Its Treatment by Radium*, neoplasms of the head and the neck, excluding the brain, are covered, with chapters devoted to the lip, tongue, mouth, cervical lymph nodes, nose and nasal sinuses, tonsil, pharynx and larynx, mucous and salivary gland tumors, and the thyroid gland.

The author's wide knowledge of malignant disease is evident from his excellent clinical descriptions, as well as his discussion of the natural history and pathology of the lesions under consideration and the criteria employed for diagnosis. Various types of therapy are outlined, with the indications and contraindications for each, and finally the author's own choice of treatment. Radium therapy is covered in detail, with numerous sketches illustrating implantation methods and teleradium technics. Appropriate cases are presented and a statistical analysis of end-results is included. At the end of each chapter is a bibliography of important references.

The book is well illustrated with black and white drawings and photographs, as well as a considerable number of pictures in color. A good index adds further to its value.

Some may feel that the author is partial to radium therapy as against x-ray therapy, but in any such appraisal the vast experience which has led him to this preference must be given due weight. This work will be of great value to the radiologist and all those caring for patients with malignant disease.

L'URÉTHROGRAPHIE. By ROGER GUICHARD, Radiologist, Hospitals of Bordeaux, and HENRY DUVERGEY, Chief of Urologic Clinic of the Faculty of Bordeaux, with a Preface by PROFESSOR DARGET. A volume of 190 pages, with 165 figures. Published by Masson & Cie, Paris, 1949.

The combined efforts of a radiologist and a urologist have produced a concise yet remarkably comprehensive monograph on the diagnostic value of urethrograms. The authors have attempted to stimulate interest in urethrography—a much neglected and frequently misunderstood procedure.

A summary of the history of urethrography is followed by a consideration of the anatomy of the area involved and the basic physiology of micturition. The technic of urethrography is presented in detail. An especially fine comparison is made of the relative merits of the retrograde and the voiding type of urethrogram. Dangers from venous reflux, drug incompatibilities, and iodide sensitivities are reviewed.

Practically every possible pathologic condition in the male urethra is illustrated with excellent photographs and clarifying diagrammatic sketches, after the reader has been first acquainted with the common variations in the normal urethra. A concluding chapter is devoted to the female urethra.

This publication should be extremely valuable to anyone who intends to interpret urethrograms.

EXPLORATION RADIOLOGIQUE DE L'APPAREIL URINAIRE INFÉRIEUR (VESSIE-URÈTRE-PROSTATE). By BERNARD FEY, FERNAND STOBBAERTS, PIERRE TRUCHOT, AND GEORGES WOLFROMM, with the collaboration of LÉONCE SABADINI, FELIX DEGAND, JACQUES DESCLAUX, GEORGES DULAC, MARCEL DUTRIEUX, MAURICE GILSON, ALEXANDRE GYÖRFI, JEAN ROUSSEAU, and ALBERT SORIN. A volume of 292 pages, with 293 illustrations. Published by Masson & Cie, Paris, 1949.

All methods of radiologic investigation of the urinary bladder, the prostate, and the urethra, in both sexes, are dealt with in this book, which is the result of collaboration between numerous urologists and radiologists, each author contributing his own personal ideas.

In the early chapters there is a clear and detailed outline of the technical factors involved in each type of examination. Various ingenious methods are presented, such as double-contrast cystography with

air and fluid, and a method in which thorium dioxide is precipitated to form a coating on the wall of the bladder, which is then distended with air. The latter method in particular seems to be especially well adapted to the study of bladder tumors, giving accurate information about the implantation, size, and contour of the neoplasms. Urethrography is also presented in detail, both the retrograde and excretory methods.

There are numerous references to the normal and pathological physiology of the lower urinary tract, with an explanation of the best method of investigation for various disease entities. The uses and indications for combined methods of examination are also brought out.

The second half of the volume is devoted to various pathologic conditions, such as congenital deformities, disorders of muscular tonus in the bladder, calculi and foreign bodies, inflammatory lesions of the bladder, urethra and prostate, vesical neck obstructions with their sequelae, traumatic lesions, neoplasms, postoperative studies, etc.

The 293 positive reproductions are of high quality, and each illustration carries a clear explanation. Both normal and pathological studies are presented. In addition to the radiologic interpretation, we are also given in each instance the clinical, cystoscopic, and surgical aspects of the case under review. The book thus constitutes a veritable atlas of lower urinary tract diseases and is to be highly recommended.

As occurs so frequently with French books, there is no bibliography and the index is sketchy.

EL NEUMOMEDIASTINO ANTERIOR ARTIFICIAL EN EL NIÑO. SU IMPORTANCIA PARA EL ESTUDIO DE LA HIPERPLASIA TÍMICA. By ANDRÉS P. H. DEGOY, Médico de la Casa Cuna, Córdoba, and SABINO DI RIENZO, Professor Adjunto de Radiologia y Fisioterapia, Córdoba. A volume of 104 pages, with 56 illustrations. Published by Librería y Editorial "El Ateneo," Florida, 340, Córdoba 2099, Argentina, 1948.

For eleven or twelve years word has come from Cuba, especially from Doctors Castellanos and Pereiras, of the help furnished by the introduction of air as the contrast medium in the study of the anterior mediastinum and neighboring organs. The technic is simple and the diagnostic possibilities are more numerous than can be offered by posterior mediastinal emphysema or pneumomediastinum.

The present authors choose to consider a relatively small group of 32 patients, 12 of whom had normal and 20 abnormal shadows in the mediastinal region. These were chosen from 600 children whose ages varied from one month to thirteen years. Fifteen children, ranging from a few days to thirty-six months of age, were selected for artificial anterior pneumomediastinum.

The authors insist that the method is simple, practical, harmless, and sure. Not only does it permit visualization of the thymus, but also it gives better estimation of the size of the heart and neighboring organs.

The illustrations are clear and intriguing and vary in pathological interest. Some are very convincing

SURFACE AND RADIOLOGICAL ANATOMY FOR STUDENTS AND GENERAL PRACTITIONERS. By A. B. APPLETON, W. J. HAMILTON, AND IVAN C. C. TCHAPEROFF. Third edition by A. B. APPLETON, M.A., M.D. (Cantab.), Professor of Anatomy in the University of London and Director of the Department of Anatomy in the Medical School of St. Thomas's Hospital, London, former Fellow of Downing College, Cambridge, W. J. HAMILTON, M.D., D.Sc., F.R.S.E., Professor of Anatomy in the University of London at Charing Cross Hospital Medical College, sometime Regius Professor of Anatomy in the University of Glasgow, formerly Professor of Anatomy in the University of London at the Medical College of St. Bartholomew's Hospital, and G. SIMON, M.D., B.Ch., D.M.R.E. (Cantab.), Demonstrator of Radiological Anatomy in the Medical College of St. Bartholomew's Hospital, and Assistant Radiologist to the Diagnostic X-ray Department, St. Bartholomew's Hospital, London. A volume of 332 pages, with 390 illustrations. Published by The Williams & Wilkins Co., Baltimore, Md., 1949. Price $9.00.

This is the third edition of a text which originally appeared in 1938. It contains many new radiographs, and some new technics have been added, such as angiocardiography. In general, however, the descriptive matter follows the same pattern as in the previous edition.

The general plan is a description of the surface landmarks with retouched photographs depicting the underlying structures at given levels. Roentgenograms of the same areas supplement sketches and photographs, but the work is not primarily a textbook on radiography. An appendix includes Tables of Ossification, giving the dates of appearance and union of the epiphyses, as well as tables presenting the segmental innervation of the muscles of the upper and lower limbs.

This text should be of considerable value in reviewing gross anatomy and surface anatomy in relation to radiology. It cannot be considered a detailed anatomical text.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Hugh F. Hare, M.D., 605 Commonwealth Ave., Boston 15, Mass.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Harold Dabney Kerr, M.D., Iowa City, Iowa.

AMERICAN COLLEGE OF RADIOLOGY. *Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6, Ill.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. D. Anderson, M.D., 420 10th St., Tuscaloosa.

Arizona

ARIZONA ASSOCIATION OF PATHOLOGISTS AND RADIOLOGISTS. *Secretary*, R. Lee Foster, M. D., 507 Professional Bldg., Phoenix.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames. M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Sydney F. Thomas, M.D., Palo Alto Clinic, Palo Alto.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, 434 30th St., Oakland 9. Meets monthly first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, Wybren Hiemstra, 1414 S. Hope St. Meets monthly, second Wednesday, County Society Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, Charles E. Grayson, M.D., Medico-Dental Bldg., Sacramento 14. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Wm F. Reynolds, M.D., University Hospital, San Francisco 22. Meets third Thursday at 7:45, January to June at Stanford University Hospital, July to December at San Francisco Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Mark S. Donovan, M.D., 306 Majestic Bldg., Denver 2. Meets third Friday of each month, at the Colorado School of Medicine and Hospitals.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Fred Zaff, M.D., 135 Whitney Ave., New Haven. Meetings bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Ellwood W. Godfrey, M.D., 1676 Boulevard, W. Hartford. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, Karl C. Corley, M.D., 1835 Eye St., N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Auditorium.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John J. McGuire, M.D., 1117 N. Palafox, Pensacola. Meets in April and in November.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Wm. W. Bryan, M.D., 490 Peachtree St., N. E. Meets second Friday September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert Drane, M.D., De Renne Apartments, Savannah. Meets in November and at the annual meeting of State Medical Association.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, John H. Gilmore, M. D., 720 N. Michigan Ave., Chicago 11. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly as announced.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Harold L. Shinall, M.D., St. Joseph's Hospital, Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, William M. Loehr, M.D., 712 Hume-Mansur Bldg., Indianapolis 4. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Anthony F. Rossitto, M.D., Wichita Hospital, Wichita. Meets annually with State Medical Society.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Everett L. Pirkey, M.D., 323 East Chestnut St., Louisville 2.

LOUISVILLE RADIOLOGICAL SOCIETY, *Secretary-Treasurer*, Everett L. Pirkey, Louisville General Hospital, Louisville 2. Meets second Friday of each month at Louisville General Hospital.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary*, J. Howard Franz, M.D., 1127 St. Paul St., Baltimore 2.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary-Treasurer*, George Belanger, M.D., Harper Hospital, Detroit 1. Meetings first Thursday, October to May, at Wayne County Medical Society club rooms.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS. *Secretary-Treasurer*, R. B. MacDuff, M.D., 220 Genesee Bank Building, Flint 3.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, C. N. Borman, M.D., 802 Medical Arts Bldg., Minneapolis 2. Meets in Spring and Fall.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Wm. M. Kitchen, M.D., 1010 Rialto Building, Kansas City 6, Mo. Meetings last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Charles J. Nolan, M.D., 737 University Club Bldg. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ralph C. Moore, M.D., Nebraska Methodist Hospital, Omaha 3. Meets third Wednesday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, George Levene, M.D., Massachusetts Memorial Hospitals, Boston. Meets monthly on third Friday at Boston Medical Library.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meetings quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Benjamin Copleman, M.D., 280 Hobart St., Perth Amboy. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M D., East Rockaway.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary*, J. Daversa, M.D., 603 Fourth Ave., Brooklyn. Meets fourth Tuesday, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*. Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 10. Meetings January, May, October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening, October to May, at 8:45 P.M., in Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, F. H. Ghiselin, M.D., 111 E. 76 St., New York.

QUEENS ROENTGEN RAY SOCIETY *Secretary*, Jacob E. Goldstein, M.D., 88-29 163rd St., Jamaica 3. Meets fourth Monday of each month.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, Ralph E. Alexander, M.D., 101 Medical Arts Bldg., Rochester 7. Meets at Strong Memorial Hospital, third Monday, September through May.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Charles Heilman, M.D., 1338 Second St., N., Fargo.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Edward C. Elsey, M D., 927 Carew Tower, Cincinnati 2 Meets with State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Paul D. Meyer, M.D., Grant Hospital, Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Seneca Hotel, Columbus.

CINCINNATI RADIOLOGICAL SOCIETY. *Secretary*, Eugene L. Saenger, M.D., 735 Doctors Bldg., Cincinnati 2. Meets last Monday, September to May.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Ha nan, M.D., Cleveland Clinic, Cleveland 6. Meetings at 6:30 P.M. on fourth Monday, October to April, inclusive.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. E. Brown, M.D., 21st and Xanthus, Tulsa 4. Meets in October, January, and May.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Boyd Isenhart, M.D., 214 Medical-Dental Bldg., Portland 5. Meets monthly, on the second Wednesday, at 8:00 P.M., in the library of the University of Oregon Medical School.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4, Wash. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, George P. Keefer, M.D., 1930 Chestnut St., Philadelphia 9. Meets first Thursday of each month at 8:00 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22d St.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, R. P. Meader, M.D., 4002 Jenkins Arcade, Pittsburgh 22. Meets second Wednesday of each month at 6:30 P.M., October to June.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., Lincoln Clinic, Lincoln, Nebr. Next meeting in Denver, Colo., Aug. 18–20, 1949.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer* Marianne Wallis, M.D., 1200 E. Fifth Ave., Mitchell. Meets during Annual Session of State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. Meetings second Tuesday of each month at University Center.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frére, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meetings on third Monday of each month in Dallas in the odd months and in Fort Worth in the even months.

HOUSTON X-RAY CLUB. *Secretary*, Curtis H. Burge, M.D., 3020 San Jacinto, Houston 4. Meetings fourth Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting Feb. 3–4, 1950, in Dallas.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk 7.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John H. Walker, M.D., 1115 Terry Ave., Seattle. Meetings fourth Monday, October through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Theodore J. Pfeffer, M.D., 839 N. Marshall St., Milwaukee 2. Meets monthly on second Monday at the University Club.

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave. Milwaukee. Two-day meeting in May; one-day with State Medical Society, September.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursdays 4 P.M., September to May, Service Memorial Institute, Madison 6.

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Jesús Rivera Otero, M.D., Box 3542, Santurce, Puerto Rico.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, E. M. Crawford, M.D. Associate Honorary Secretary-Treasurer, Jean Bouchard, M.D. *Central Office*, 1535 Sherbrooke St., West, Montreal 26, Quebec. Meetings in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origéne Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPIA *General Secretary*, Dr. Dionisio Pérez Conio, Marsella 11, México, D. F. Meetings first Monday of each month.

ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

The Chest

The Digestive System

The Musculoskeletal System

Blood Vessels

Obstetrics and Gynecology

The Genito-Urinary System

Miscellaneous

RADIOTHERAPY

RADIOACTIVE ISOTOPES

EXPERIMENTAL STUDIES

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Subtotal Craniectomy for Osteomyelitis of the Skull. Dean H. Echols and J. A. Colclough. Am. J. Surg. **76:** 443–445, October 1948.

The authors report a case of extensive osteomyelitis of the skull treated by repeated surgical excision so that finally a subtotal craniectomy had been performed. This included the removal of both parietal bones, the greater part of the frontal bone, the temporal bones to their petrous portions, and the occipital bone to and including the posterior margin of the foramen magnum.

The important features were: irregular, spontaneous drainage of painless abscesses in the upper eyelids associated with frontal headaches; palpable destructive areas in the skull; a 4 plus Kline reaction; culture of *Staphylococcus aureus* and an anaerobic streptococcus from the wound. Roentgenograms showed areas of destruction and sequestration in the frontal region, with thickening of the entire skull. The case was diagnosed as a mixed syphilitic and pyogenic osteomyelitis of the skull.

After six months of good health, the patient, a forty-year-old negress, died of pneumococcic meningitis, eight months after the final resection. She had been examined four months after the final resection and at that time was well and had no complaints. Her head was soft but the brain was apparently well supported by the dura, periosteum, and scalp, which post mortem were found to be greatly thickened.

Three roentgenograms. JOHN F. WEIGEN, M.D.
University of Pennsylvania

Primary Diffuse Parathyroid Hyperplasia in an Infant of Four Months. Robert N. Philips. Pediatrics **2:** 428–434, October 1948.

A fatal case of primary diffuse parathyroid hyperplasia in a four-month-old infant is reported. Findings included severe hypercalcemia, enlargement of at least three of the parathyroid glands, generalized osteitis fibrosa, and calcium deposits in the kidneys, lungs, bronchial cartilage, thymus, and choroid plexus. The early onset of symptoms and the extensive anatomic changes in this case suggest the possibility of a congenital origin. Although the left upper parathyroid was not grossly enlarged, it was histologically identical with the other three glands.

Three roentgenograms; 1 photograph; 3 photomicrographs.

THE CHEST

Demonstration of the Bronchial Tree with Water-Soluble Contrast Medium. F. K. Fischer. Schweiz. med. Wchnschr. **78:** 1025–1033, Oct. 23, 1948. **Contribution to the Technic of Bronchography with a Water-Soluble Contrast Medium, Ioduron-B.** F. K. Fischer and K. Mülly. Ibid. 1033–1035, Oct. 23, 1948. (In German)

The use of iodized oil for bronchography has the disadvantage that oily deposits sometimes remain in the lungs for years, interfering with subsequent roentgenologic study. There is also some question as to whether the residual deposits may not lead to late pathological changes. In some diseases, the iodine component may of itself be harmful. It is true that reports of injury are rare, but this may be due to the fact that only irreparable or lethal damage is generally reported. The literature both on injuries and on previous attempts to use a water-soluble medium for bronchography is discussed and reviewed.

Of the water-soluble media available, preference is given to Ioduron-B, a product developed in collaboration with Cilag Schaffhausen. The drug is prepared in a 50 per cent viscous aqueous solution. It is well tolerated, produces good bronchograms without excessive coughing, has no side reactions, and disappears from the lungs in three or four hours. It may be diluted with normal saline if a thinner solution is desired.

In the second of the articles listed above, the technic, indications, and results of bronchography are reviewed as they bear on the use of this medium. In general, there is little new material included; the medium is used in much the same manner as iodized oil, the authors preferring the catheter method of instillation.

Twenty-one bronchograms.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Primary Bronchogenic Carcinoma. Correlation of Recent Literature with One Hundred and Thirty-One Proved Cases. John J. O'Keefe. Arch. Int. Med. **82:** 345–361, October 1948.

One hundred and thirty-one cases of proved primary bronchogenic carcinoma from the Philadelphia General Hospital (1940–46) are analyzed and the findings are correlated with data in the recent literature.

In the present series there were 125 men. Eighty-two of the patients were between the ages of fifty and seventy. The time between initial symptoms and hospitalization was more than a year in 22 cases, six months to one year in 24, and less than six months in 78. Subsequent to diagnosis, 111 patients (84.7 per cent) died within eighteen months. The only deviation in the present series from the generally accepted figures was the almost equal distribution between the left and right lung, the carcinoma occurring in the right lung in 63 cases and in the left in 68 cases. The tumor was of the squamous-cell variety in 114 cases and of the adenomatous type in 17, a proportion of 6.7 to 1.

The author states that the roentgenogram is probably the most valuable single means of obtaining an early presumptive diagnosis of bronchogenic carcinoma. Mass chest surveys, initially intended as a check for tuberculosis, have proved equally valuable in detecting the presence of malignant growths. Several weaknesses in this procedure are apparent, however; a single film is often not sufficient, especially a single postero-anterior view; initial negative reports are considered as final, and, because of a false impression or a mistaken original diagnosis, re-evaluation is not attempted until much time has been lost.

In the present series of 131 cases, the roentgenologic diagnosis was positive in 70 cases (53.4 per cent) and indefinite or false in 22 (16.7 per cent); there was no report in 39 cases. The histologic diagnosis was positive in 98 cases (74.7 per cent); there was no report in 33 cases.

The therapeutic approach to carcinoma of the lung, as with carcinoma elsewhere, is dependent on the extent of involvement at the time of diagnosis. It is defined as either palliative (in cases beyond hope of cure) or

definitive (in those in which the tumor is considered early and operable). There are three methods of attack: bronchoscopic, with removal of tissue by forceps or by electrocoagulation, or both; roentgenologic, in the form of high-voltage irradiation or implantation of radon seeds or radium directly into the tumor; surgical, by extirpation of the diseased organ. The last is the only method offering possible cure.

Eleven illustrations, including 6 roentgenograms; 5 tables.

Pitfalls in the Early Diagnosis of Carcinoma of the Lung. C. Allen Good. Minnesota Med. **31:** 1087–1092, October 1948.

Because so much depends on early diagnosis of carcinoma of the lung, it behooves all physicians to be aware of the pitfalls which can delay early recognition of a pulmonary carcinoma. Three of these pitfalls result from the tendency for this malignant lesion to masquerade in benign costume. The pitfall of the *benign tumor* can be avoided by the early use of exploratory thoracotomy whenever a single circumscribed mass which eludes diagnosis by all other methods is present in the lung. The pitfall of the *pulmonary abscess* can be avoided by the analysis of sputum, bronchoscopy, and biopsy, and even exploratory thoracotomy, in all cases of chronic cavitating disease of the lung encountered in an adult patient for which some specific etiologic factor cannot be found. The pitfall of *pneumonia* can be avoided by the use of the follow-up roentgenogram, and by maintenance of a high degree of suspicion for any lesion which does not disappear roentgenologically in ten to fourteen days. A constant awareness of these problems by all physicians will make for earlier diagnosis of malignant disease of the lung. This in turn will improve the results of surgical procedures, the only satisfactory method of treatment for this disease known today.

Six cases illustrative of the pitfalls discussed are reported.

Fourteen roentgenograms.

Osteopathic Form of Bronchial Cancer. Julio García Otero and N. L. Caubarrère. Schweiz. med. Wchnschr. **78:** 934–937, Sept. 25, 1948. (In French)

Attention is directed to the fact that the first symptoms of pulmonary cancer may be rheumatic pains associated with hypertrophic pulmonary osteoarthropathy. Such a case is reported. A 59-year-old man had pain in the knees for three months, with no pulmonary symptoms. X-ray study showed the changes of hypertrophic pulmonary osteoarthropathy, and the resulting study of the lungs demonstrated a large tumor in the base of the left lung posteriorly, which was removed; the pathological diagnosis was "malpighian epithelioma." The joint symptoms cleared completely forty-eight hours postoperatively, except for the permanent morphologic changes. In four months mediastinal masses had developed, resistant to irradiation therapy, and six months after that a large nodule had appeared in the right lung. The author feels that the finding of an unexplained hypertrophic pulmonary osteoarthropathy should lead to a careful search for a pulmonary neoplasm.

Six roentgenograms; 1 photograph.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Bronchial Adenoma. Carlton R. Souders and J. W. Kingsley, Jr. New England J. Med. **239:** 459–466. Sept. 23, 1948.

Bronchial adenomas comprise about 6 per cent of all primary bronchial tumors. They arise in the submucosa of the bronchial walls, possibly from the bronchial glands or ducts. The growth is usually situated in a primary bronchus and is frequently visualized through the bronchoscope. The tumor is a rounded pink or purplish mass attached by a broad base and may bleed profusely following manipulation.

Histologically, bronchial adenomas may be carcinoids or cylindromas. There is some difference of opinion as to the possibility of some of these tumors being malignant, but by far the majority are benign.

This growth is usually seen in patients under forty years of age. There may be a history of respiratory symptoms of several years duration, with cough that is particularly distressing at night. Hemoptysis is of frequent occurrence; there may be wheezing; dyspnea is usually not extreme; chest discomfort occurs, and after some time pulmonary infection develops. The physical findings are in direct proportion to the amount of bronchial obstruction and pulmonary involvement.

There are no roentgenographic findings characteristic of bronchial adenoma, but changes due to obstructive phenomena may be observed. Fluoroscopy, Bucky films, and films on inspiration and expiration are indicated in these patients. Body-section roentgenography and bronchography are of value. The final diagnosis is made by biopsy.

Treatment consists of local removal if this can be accomplished without too much difficulty or a surgical resection of a lobe or entire lung.

Seven illustrations including 5 roentgenograms; 2 tables.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Management of the Pulmonary "Coin" Lesion. E. J. O'Brien, Wm. M. Tuttle, and Joseph E. Ferkaney. S. Clin. North America **28:** 1313–1322, October 1948.

As chest x-ray studies of large groups are being conducted, numerous peculiar and confusing rounded shadows are being encountered. These coin-like densities may represent primary malignant or benign tumors, tuberculomas, chronic indolent abscesses, or metastatic tumors.

The present study is based on 21 patients seen over a period of two and a half years, in none of whom was a diagnosis definitely established prior to operation. The final diagnoses were: bronchogenic carcinoma in 8 cases, sarcoma in 1 case, tuberculoma in 8, cyst in 1, abscess in 2, and chondroma in 1. Six of the 21 patients had no symptoms, the pulmonary lesions being discovered on a routine chest film. In 2 others the lesions were also accidental discoveries, though a history of symptoms was later elicited. Cough appeared to be the commonest symptom, but was not characteristic in any respect. Hemoptysis occurred in 4 patients, but in only one case was a large amount of blood raised.

A comparative study of a series of films obtained over a period of months or years, if available, may be of considerable aid in diagnosis. If the shadow is shown to be increasing in size, a malignant tumor may well be suspected. Abscesses and tuberculomas also grow, however, and on the other hand, a malignant lesion may

remain stationary for months. Tuberculous lesions are generally more sharply circumscribed than a malignant tumor and may contain calcium in their centers. Unfortunately, too much reliance cannot be placed on this last finding, since carcinomas have been known to arise around a Ghon tubercle and long-standing pulmonary abscesses may contain calcium in their walls or centers.

Because of these difficulties in diagnosis and the high percentage of cases proved to be malignant, the authors advocate prompt pulmonary resection in the presence of these rounded lesions. It has become increasingly evident that pulmonary parenchymal tuberculomas do poorly when treated by streptomycin, collapse therapy, or by the more conservative regimen of bed rest. They tend in time to excavate, leaving a cavity with a thick non-resilient wall, which is not influenced by collapse measures. Abscesses and cysts also are best treated by resection. Thus there remains no logical reason for temporizing in the treatment of the rounded or "coin" lesion of the pulmonary parenchyma. Too often, to do so is to waste time, and frequently life.

Seven roentgenograms; 1 photograph; 1 table.

S. F. THOMAS, M.D.
Palo Alto, Calif.

Endobronchial Polypoid Hamartochondroma: Review of the Literature and Report of a Case. R. W. Postlethwait, R. F. Hagerty, and J. C. Trent. Surgery **24:** 732–738, October 1948.

The thirteenth reported case of endobronchial polypoid hamartochondroma is added to the literature.

These benign lesions have been defined as "tumor-like malformations in which occur only an abnormal mixing of the normal components of the organ. The abnormality may take the form of a change in quantity, arrangement, or degree of differentiation, or may comprise all three. The deduction to be drawn from histologic examination of these formations is that they have originated in an abnormal mixing of normal elements or from disturbance of their development."

Intrapulmonary lesions may remain asymptomatic, and grow to considerable size before causing symptoms; a small endobronchial tumor, however, may produce severe symptoms early, due to obstruction. X-ray examination may be of value in revealing the changes associated with bronchial occlusion. In 3 of the reported cases lipiodol studies showed failure of a lobe or segment to fill with the radiopaque material. Intrapulmonary tumors may require resection, while endobronchial masses may be removed through the bronchoscope.

Two roentgenograms; 1 diagram; 1 table presenting details of the reported cases. Good bibliography.

J. E. WHITELEATHER, M.D.
Memphis, Tenn.

Pulmonary Affections of Occupational Origin. Rutherford T. Johnstone. Am. Rev. Tuberc. **58:** 375–392, October 1948.

The author discusses briefly the significance and effects of the inhalation of certain dusts in industry. Concerning the harm which may result from the inhalation of industrial dusts, consideration must be given to the factors of weight, particle size, and concentration, as well as to the chemical nature of the dust.

Iron Dust: Inhalation of iron dust for a number of years will produce a fine nodulation throughout the lungs. There is, however, no reactive fibrosis, no disability, and no predisposition to tuberculosis. The process is designated as a "benign pneumoconiosis."

Cement Dust: Examination of large numbers of workers in the cement industry leads to the conclusion that this dust is harmless. It causes no nodulation demonstrable on chest roentgenograms or other clearly recognizable change.

Cotton Dust: Cotton dust causes no appreciable fibrosis but is capable of being allergenic. Byssinosis is a peculiar respiratory affection resulting from the inhalation of cotton fibers and is characterized by the signs and symptoms of asthma and bronchitis. The cause of the disturbance is a fungus or mold.

Bagassosis: Bagassosis results from the inhalation of bagasse, the residuum of sugar cane after the sugar has been extracted. The cause is believed to be an antigen in the bagasse. No definite roentgen picture has yet been established.

Fiberglass: Thus far no evidence has been found to indicate that inhalation of this dust will cause pulmonary damage.

Other Inert Dusts: Many other dusts may be encountered in an industrial environment, such as carbon, calcium carbonate, tobacco, sugar, etc. None of these will produce appreciable pulmonary fibrosis.

Bauxite: Recently it has been shown that in the manufacture of abrasives, when a mixture of bauxite (hydrous aluminum oxide) and other substances is subjected to high temperatures, inhalation of the resulting fumes may lead to severe pulmonary disease. The roentgenographic findings include irregular tenting of the diaphragm, widened mediastinal shadow, a lace-like granular change in the lungs, with emphysema and ring-like shadows in the advanced cases.

Diatomaceous Earth: While previous experience, both clinical and experimental, led to the belief that the inhalation of this substance would not produce fibrosis, recent evidence strongly indicates that fibrosis with nodulation has occurred in some instances of exposure to calcined diatomaceous earth. This substance when subjected to high degrees of heat may release a crystalline silica. Changes occur in the lungs similar to those seen in bauxite workers. It appears, therefore, that these silicates, while ordinarily inert, may become harmful when subjected to high temperatures.

Beryllium: While metals as a group do not affect the lungs, two exceptions are noteworthy, beryllium and cadmium. No uniform name has been adopted for the disease resulting from the inhalation of beryllium. Clinical symptoms include weakness, loss of weight, shortness of breath, anorexia, and non-productive cough. The early roentgenographic appearance is that of a fine sandpaper-like granularity. Later, a diffuse reticular pattern is seen and the hilar shadows become fuzzy. Distinct nodules appear uniformly throughout the lung fields.

Cadmium: Cadmium oxide, when inhaled, has probably more lethal potentialities than any other metal. It becomes so only when subjected to high temperatures. The symptoms develop acutely and progress rapidly, with cough, headache, dizziness, constriction in the chest and marked dyspnea. The roentgenogram shows a widespread patchy bronchopneumonia. At autopsy, edema and congestion of the lungs are noted, with a proliferative interstitial pneumonia and catarrhal bronchitis. These changes are chemical in origin.

Silicosis: Silicosis and asbestosis are not included in

this article since it is assumed that readers are familiar with the various aspects of these diseases.

Eleven roentgenograms. L. W. PAUL, M.D.
University of Wisconsin

Silicosis Simulating a Unilateral Pulmonary Tumor. Pleuroscopic Appearance and Diagnostic Importance. M. Delord and F. Besson. J. franç. méd. et chir. thorac. **2:** 552–556, 1948. (In French)

A 29-year-old soldier who had been a coal miner for seven years presented himself because of cough and dyspnea. He had been away from the mines for three years. Previous fluoroscopic studies of the chest had been reported as negative. A film now showed a homogeneous opacity in the left infraclavicular area, measuring 3 × 4 cm. in diameter. The remainder of the lungs showed a diffuse reticulo-nodular thickening of the pulmonary markings. Sputum examinations were negative for tuberculosis. Bronchograms showed a funnel-shaped narrowing of the divisions of the dorsal bronchi of the left upper lobe. An aspiration biopsy yielded serous fluid which transmitted tuberculosis to an inoculated guinea-pig. Pleuroscopic examination showed the entire left lung studded with slate-colored diamond-shaped plaques measuring about 1.5 cm. in diameter.

After two years of sanatorium care the patient is clinically well and the roentgen lesion is stationary.

Silicosis usually gives bilateral evidence of disease and there are instances in the literature where lobectomies and pneumonectomies were performed because of unilateral lesions simulating a neoplasm. The widespread plaques on the pleura have received very little attention in the literature and were interpreted as resulting from a massive impregnation of the lung by noxious dusts. The authors believe this case to be important because of the rather sudden appearance of the pseudo-tumor nine months after a negative fluoroscopy, and as showing the necessity of frequent inoculations of guinea-pigs in order to prove the presence of tuberculosis in a large number of silitcoic patients.

Three roentgenograms. E. M. SAVIGNAC, M.D.
Detroit, Mich.

Delayed Pneumonitis in a Beryllium Worker. Report of a Case. John N. Agate. Lancet **2:** 530–533, Oct. 2, 1948.

A case of chronic pneumonitis in a laboratory worker is recorded, developing three years after exposure to a phosphorescent powder (zinc beryllium manganese silicate) used in making fluorescent lamps. The patient inadvertently exposed himself to risk, it not being generally understood that the degree of exposure needed for this dust to cause harm is much less than that usually required to bring about occupational pulmonary disease. Cough, dyspnea, and extreme loss of weight were the chief clinical features.

Roentgenography showed fine punctate or granular markings scattered throughout the lung fields with subsequent reticulation and fine nodulation. Still later there was a coarsening of the reticular pattern with an increase of linear striae suggesting fibrosis, and a decrease in nodulation. Granulomatous lesions were found in the liver without biochemical evidence of liver disorder. The chronicity of the condition and the serious residual disability are considered typical.

Two photomicrographs.

Asymptomatic Minimal Pulmonary Tuberculosis: Assessment of Status: Results of Supervision and Treatment. Hugh E. Burke and John L. Parnell. Canad. M. A. J. **59:** 348–353, October 1948.

In an effort to determine the value of certain objective criteria used in the assessment of the status of tuberculous lesions in individuals who denied symptomatology within a period of weeks or months prior to the discovery of their disease, the authors reviewed the records of 443 cases of so-called asymptomatic minimal tuberculosis.

All the cases included in the study were discovered either on mass survey x-ray examination or on routine x-ray examinations of families in which a case of tuberculosis had recently been discovered.

It is concluded that physical examinations, including a search for latent râles, are of little or no value in the assessment of the status of tuberculous lesions of minimal extent. Serial film study and bacteriologic examination of sputum and/or gastric washings obtained from patients who deny cough and expectoration are, on the other hand, invaluable aids in the assessment of the status of minimal disease found on routine x-ray examination.

The authors add that lack of adequate sanatorium facilities for the treatment of persons with active tuberculous lesions is still a definite factor in the problem of control. ROBERT H. LEAMING, M.D
Jefferson Medical College

Bronchoscopy in Pulmonary Tuberculosis. A Study of Post-Bronchoscopic Increase of Disease. E. Osborne Coates, Jr. Am. Rev. Tuberc. **58:** 412–420, October 1948.

The present study was undertaken to determine the statistical frequency of increase of disease following bronchoscopy in patients with active pulmonary tuberculosis and to investigate certain aspects of those cases in which it occurred. The survey includes all bronchoscopies done on patients with pulmonary tuberculosis in Trudeau Sanatorium during a ten-year period, comprising 473 examinations in 233 patients. The material is presented in a series of tables. It was found that the incidence of roentgenographic increase of disease in the two months immediately following bronchoscopy was no greater than in other two-month periods before bronchoscopy. Patients with far-advanced disease showed no greater incidence of post-bronchoscopic increase in involvement. The presence of active endobronchial tuberculosis could not be shown to be a factor in the development of post-bronchoscopic increase in the disease. Atelectasis occurred only once in 73 cases showing increase of disease after bronchoscopy.

Four tables; 1 chart. L. W. PAUL, M.D
University of Wisconsin

Direct Radiologic Diagnosis of Tracheobronchial Tuberculosis. Manuel Tapia. Gaz. méd. Portuguesa **1:** 431–474, 1948. (In Spanish)

The problem of the radiologic diagnosis of tracheobronchial tuberculosis is discussed. Tomography was found of considerable value, especially when bronchoscopy was contraindicated or when the lesions could not be visualized. The diagnosis in most cases was confirmed by bronchoscopy.

After describing the normal tracheobronchial tree,

the author analyzes the alterations which lead to the tomographic diagnosis of tracheal and bronchial lesions. These alterations are as follows:

1. Changes in the bronchial caliber
   - Homogeneous stenosis
   - Stenosis with sinuous contour
   - "Wasp-waisted" stenosis
   - Funnel stenosis.
2. Changes in the bronchial contour
   - Waved wall, resulting in reduction of caliber
   - Localized waving, giving a mammillated image
   - Serrated contour.
3. Demonstration of hilar bronchi, normally invisible.
4. Ampullar dilatation of the first bifurcation.
5. Alteration of the tracheal contour.
6. Appearance of calcified lesions on the tracheobronchial wall.

Forty-seven roentgenograms and tomograms; 2 photographs.

Preliminary Report on a Community-Wide Chest X-Ray Survey at Minneapolis, Minnesota. Wm. Roemmich, Francis J. Weber, Frank J. Hill, and Lucille Amos. Pub. Health Rep. **63:** 1285–1290, Oct. 1, 1948.

The authors report a chest x-ray survey conducted in Minneapolis, designed to cover every person fifteen years old and over. A total of 301,513 films (70-mm.) were obtained. Of these, 291,275 (96.6 per cent) were negative; 5,977 (2 per cent) were interpreted as suspicious of tuberculosis, and 4,261 (1.4 per cent) of other chest disease.

Of 9,236 persons who were given appointments for confirmatory 14 × 17-inch films, 8,333 responded; in 2,331, or 28 per cent of this number, the findings were essentially negative; evidence of tuberculosis was obtained in 3,850, or 46.2 per cent and of other chest disease in 2,152, or 25.8 per cent. Of the tuberculous lesions, 84.8 per cent were classified as minimal, 13.3 per cent as moderately advanced, and 1.9 per cent as far advanced.

Of the 6,002 persons with positive findings on the 14 × 17-inch films, 4,219 were referred to private physicians and 1,783 to public clinics for clinical evaluation. Completed records were available for 1,500 of these at the time of this report. These showed:

Negative chest	159 (10.6%)
Tuberculosis	648 (43.2%)
Other chest disease	585 (39.0%)
No diagnosis made	108 (7.2%)

Of those with a diagnosis of tuberculosis, 428 had bacteriologic studies (sputum smears or cultures or gastric cultures), with positive findings in 79, or 19 per cent. This represents 1.87 per cent (abstractor's figure) of the 4,219 referred cases and 5.3 per cent (abstractor's figure) of the 1,500 cases with complete records to date.

Nine tables.

S. F. THOMAS, M.D.
Palo Alto, Calif.

Findings of a Chest X-Ray Centre. J. N. Burgess. M. J. Australia **2:** 494–496, Oct. 23, 1948.

A series of 10,000 chest films taken at Moreland, a suburban center of Melbourne, Australia, is analyzed. There were found 32 cases of presumably active and infective tuberculosis (recorded from 17 × 14-inch films) and 73 of apparently healed lesions. According to these figures there are 3.2 persons per thousand with active disease, which would make an estimated 320 in the district covered by the survey, whose population is about 100,000. If, in addition, two-thirds of the apparently healed lesions are only quiescent, the number would be raised to 5.6 per thousand, or 560 for the district.

The figures obtained are compared with those for Williamstown, another community, which showed a somewhat higher incidence. Results from 56,500 films in six mass radiography centers in Victoria over a period of three years are also tabulated. On the basis of the various findings, it is concluded that 8 persons per thousand, or 16,000 apparently healthy persons in the entire state of Victoria, have radiologically active tuberculosis.

Two tables.

D. R. BRYANT, M.D.
The Henry Ford Hospital

Mass Photofluorography in a Naval Shipyard. Melville J. Aston and William D. Loeser. U. S. Nav. M. Bull. **48:** 809–818, September–October 1948.

These authors point out that for few mass surveys for tuberculosis are follow-up studies over three or four years available. Their study was made in a naval shipyard now employing 10,070 persons as compared with a wartime peak of 42,808. In the original survey 6,000 notations of pathologic conditions were made and 41,000 negative readings were recorded. Of 1,476 primary tuberculous lesions and 402 secondary lesions, only 46 cases considered clinically significant remain under the surveillance of the division of industrial medicine, which has followed them with roentgenographic examinations at monthly to yearly intervals, routine blood studies, sputum smears, and tuberculin tests.

On the basis of their observations the authors reach the following conclusions:

"The interpretation of the roentgenogram of a given case of suspected tuberculosis is useful in determining the presence of active disease but must not be counted on as being entirely accurate. In the 6 cases with definite activity reviewed and followed for three years, the original roentgenogram interpretation was accurate as to the activity in 4 and inaccurate in 2 cases. Of 22 cases having definite pulmonary lesions, but with no subsequent activity, the original interpretation of the roentgenogram was correct in 17, incorrect in 3, and indefinite in 2 cases.

Many persons under observation for tuberculosis for three to three and a half years were found to be tuberculin-negative to small doses. It is felt that the value of future surveys would be enhanced by inclusion of tuberculin testing of those patients screened by roentgenography both for diagnostic and investigative purposes.

Two tables.

Pathogenesis of Coccidioidomycosis with Special Reference to Pulmonary Cavitation. Charles Edward Smith, Rodney Rau Beard, and Margaret Taiko Saito. Ann. Int. Med. **29:** 623–655, October 1948.

Among the complications of *Coccidioides* infection is pulmonary cavitation or even spontaneous pneumothorax or hydropneumothorax. Between these conditions and the progressive or disseminating form of coccidioidomycosis there exists considerable confusion.

It is the hope of the authors to contribute to the clarification of this situation and to provide help in distinguishing coccidioidal cavitation from tuberculosis.

Coccidioidal pulmonary cavitation is not in the category of disseminating or progressive coccidioidal granuloma. The authors have never seen dissemination occur in a patient with cavitation.

The cavity may appear transiently during the acute infection, and thus be missed; it may develop months after the acute infection has subsided, as shown in routine chest surveys of military personnel, or may even develop after a completely inapparent primary infection. The incidence is difficult to assess, but the authors believe it to be much higher than that of dissemination. Fortunately the condition is relatively benign.

The authors had available for study records of 274 patients, military and civilian, with cavities which were unquestionably coccidioidal (cultures and animal inoculations positive for the fungus, positive serology, or a positive coccidioidin test in association with a negative tuberculin test). Of 153 cases in the military group, 88 were incidental findings on routine roentgenograms, roentgenograms taken for some other purpose, or, in 3 instances, in the course of a coccidioidin survey; 17 of 71 civilian cases were discovered incidentally. (Information on this point was available in only 224 cases.)

The outstanding sign or symptom produced by the cavitation is hemoptysis. Nearly three-fifths of the authors' civilian group were detected due to that danger sign. Chest pain, cough, malaise, fever or excessive sputum accounted for only one-tenth of the military and civilian discoveries. Thus the benign clinical nature of most coccidioidal pulmonary cavities is evident. This is in marked contrast to the fever, malaise, asthenia and severity of the illness observed in disseminated infection (coccidioidal granuloma).

In 269 cases the number of cavities was determined. While a solitary cavity is "characteristic," multiple coccidioidal cavities do occur. Nine-tenths of the cavities in this series were single; 4 per cent were multilocular. No outstanding predilection for the right or left side was observed; 70 per cent were in the "upper" chest and 30 per cent in the "lower." One-eighth were actually reported as "apical," posing emphatically the question of differentiation from tuberculosis.

The first step in determining the nature of the cavitation is a coccidioidin skin test. Precipitin and complement-fixation tests and the sedimentation rate are further aids to diagnosis. Since the condition is essentially benign and the risk of dissemination and contagion remote, drastic measures should be reserved for specific indications. Surgical removal of a persistent subpleural cavity may be undertaken to eliminate the hazard of spontaneous hydropneumothorax.

Twenty roentgenograms; 8 tables.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Air-Filled Bulla Secondary to a Lung Abscess. Mannes and Tixhon. J. franç. méd. et chir. thorac. **2:** 579–582, 1948. (In French)

Numerous references are found in the literature dealing with air-filled bullae following pulmonary disease. Usually they appear following bronchopneumonia in childhood, or a staphylococcus infection of the lung; only rarely have they been seen after an ordinary abscess. The pathogenesis has always been obscure.

The authors' patient was a 50-year-old female who had a right pulmonary abscess following surgery for acute appendicitis. The family physician treated her unsuccessfully by daily intramuscular injections of penicillin (300,000 units). Three months after the onset of symptoms she came to the attention of the authors, who instituted vigorous treatment with bronchial instillations of penicillin as well as heavier parenteral doses. The penicillin entered the abscess cavity freely. After four months of continued treatment the abscess had healed completely but a large residual air-filled bulla was present, without fluid formation and with no reaction in the adjacent lung tissue. Lipiodol instillation showed an absolutely free communication between the bulla and two separate bronchi; the oil was also easily evacuated.

Numerous theories dealing with the formation of bullae have emphasized an obstructive phenomenon or a ball-valve effect, which certainly was not present in this instance. This case suggests rather parenchymal disintegration without formation of fibrous tissue during the rapid healing induced by the antibiotics.

Seven roentgenograms. E. M. SAVIGNAC, M.D.
Detroit, Mich.

Some Aspects of Right Upper Lobe Pneumonia in Children. A. I. Suchett-Kaye. Arch. Pediat. **65:** 546–554, October 1948.

The author makes a rather unconvincing case for considering that there is something different about lobar pneumonia when it involves the right upper lobe. He says that the axillary portion of the lobe is the site of the process and that the extension to the apex is rare. This localization makes it difficult to demonstrate the physical signs but scarcely constitutes a separate entity. One peculiar feature is that some of these patients complain of abdominal pain, usually epigastric. No explanation is offered for this.

The rest of the discussion could be applied to lobar pneumonia in any part of the chest. Eight cases are reported in some detail, all showing typical clinical and x-ray findings. There are no illustrations.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Atypical Pneumonia in Infancy. Roberto Valdés Díaz, José Díaz Rousselot, René Montero, and Raúl Pereiras. Rev. cubana pediat. **20:** 503–528, September 1948. (In Spanish)

The authors present a study of atypical pneumonia as seen in 20 children ranging in age from less than a year to eight years. They describe the radiologic aspects as follows: The changes are usually apparent at forty-eight to seventy-two hours, though in some cases they are not evident until four or five days after onset of symptoms. The lesions are most frequently located in the hilus, in the form of peribronchitis, which reaches out toward the periphery as a slightly dense, fairly light shadow, more dense in the center than at the periphery. This localization, although the most frequent, is not the only one. The involvement may be primarily in the lower lobes, or in the right upper lobe, when the shadow is retrocardiac. Lateral and oblique films are requisite. Occasionally there may be infiltrative foci in the periphery or in the cardiophrenic angles.

The radiologic shadows may be described as homogeneous, nodular, or blotchy. The aspect is pseudo-

parenchymatous, so-called because it does not show the marked opacity of ordinary pneumonia; even when the density is intense, it has a massive, homogeneous, diffuse, and irregular border and in the center a certain sand-like aspect. If there is a factor of atelectasis present, then the lesion may take on a lobar aspect. At other times shadows resembling tufts of cotton are present, infiltrating and rounded, with diffuse borders and with the general appearance of bronchopneumonia. Resolution is seen radiologically as a progressive diminution of density, occurring from the periphery to the center. This requires four to five days, although sometimes it may extend over six weeks.

Nine roentgenograms; 4 photomicrographs.

JAMES T. CASE, M.D.
Chicago, Ill.

Role of Delayed Gastric Emptying Time in the Etiology of Aspiration Pneumonia. Harold F. Chase. Am. J. Obst. & Gynec. **56:** 673–679, October 1948.

The author discusses the effect of analgesic or amnesic agents, commonly employed in obstetrics, in causing a delay in the passage of food from the stomach. By means of serial roentgen studies he investigated the delay in gastric emptying in dogs following the administration of seven commonly used analgesics. With certain of these a delay of one to nine hours beyond the normal emptying time was observed. This delay may be brought about by the emotional and physical strain of labor in synergism with the smooth muscle action of the analgesics employed.

It is well known that digestion may cease when labor starts, and undigested food would thus remain in the stomach at the time when anesthesia is induced prior to delivery.

It was found that barbiturates, amytal and seconal or pentobarbital, produced ataxia but caused little delay in the emptying time. Meperidine, methadon, morphine, and scopolamine definitely prolonged the emptying time. The use of these latter medications increases the incidence of vomiting and regurgitation under general anesthesia and this in turn may increase the incidence of aspiration pneumonia.

Two tables.

ROBERT H. LEAMING, M.D.
Jefferson Medical College

Transient Pulmonary Opacities Secondary to a Furuncle of the Lumbar Region. A. Levi-Valensi. J. franç. méd et chir. thorac. **2:** 583–586, 1948. (In French)

Staphylococcic infections of the lungs have recently attracted considerable attention because of the wide variety of roentgen patterns they produce, and because of the rather numerous diagnostic errors involved. The most frequent patterns reported have been "regressive opacities" or "nebulous opacities." Also reported are air-filled bullae and, most recently, the coexistence of rounded opacities and air- and fluid-filled shadows.

The author presents a case of staphylococcic pneumonia in a patient with an old chronic tuberculosis. At first the clinical picture suggested a reactivation of the tuberculous infection but no bacilli were detected in the sputum. The films showed ill-defined opacities of varying size, shape, and density in both upper lobes, at the site of the chronic tuberculous lesions. Repeat films twenty days later showed these opacities to have resolved but revealed similar shadows in the periphery of both pulmonary bases. It was then learned that one month before the onset of her pulmonary illness the patient had a furuncle in the lumbar region which had been drained and had healed promptly. She was therefore given large doses of penicillin, with complete resolution of the lung infection within ten days.

The author speculates as to the pathogenesis of staphylococcus infections of the lungs. It would appear that ordinarily these infections are the result of bacterial embolism resulting in ordinary inflammatory or suppurative lesions, or in "staphylomas" which, after liquefaction and evacuation, produce cystic areas or small abscesses which are subsequently blown up by an obstructive bronchitis, and finally by combined areas of atelectasis and obstructive emphysema.

In the present instance the picture suggests transient phenomena similar to vasomotor reactions which may be induced by the toxin of the staphylococcus.

Two roentgenograms.

E. M. SAVIGNAC, M.D.
Detroit, Mich.

Pulmonary Embolism Without Infarction. Robert Shapiro and Leo G. Rigler. Am. J. Roentgenol. **60:** 460–465, October 1948.

It is well known that many cases with a clinical picture of typical pulmonary embolism will not show a dense shadow in the lungs as expected. Instead, as the authors point out, if we look for it, we will see just the opposite. As a pulmonary artery is occluded, the distal branches will empty themselves and remain empty. Since about 90 per cent of the markings on a negative chest film are the shadows of the pulmonary arterial system, that area on the chest film which has had its pulmonary artery occluded will become more radiolucent than the surrounding lung and will show a localized decrease in the lung markings.

Three case reports are given but in the accompanying illustrations the detail of the lung markings is unfortunately almost completely lost. Having read the article, one will be more apt to look for either density or lack of density when the question of pulmonary embolism is raised.

Five roentgenograms; 1 photograph.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Traumatic Bronchial Rupture with Occlusion. Philip J. Hodes, Julian Johnson, and Joseph P. Atkins. Am. J. Roentgenol. **60:** 448–459, October 1948.

Severe injury to the chest with or without fracture can cause a tear in one of the main stem bronchi resulting in shock, interstitial emphysema, and dyspnea. If the patient survives the initial episode, the lung may appear entirely normal for a time. Occlusion of the bronchus may then develop, with complete collapse and marked shifting of the mediastinum. Bronchograms reveal the occlusion but may lead one to suspect tumor as the cause. Pneumothorax and sometimes even pneumonectomy is required to relieve the dyspnea caused by the mediastinal shift. Thoracoplasty has not been tried but should give relief.

A detailed report of a case is given with a review of the literature and discussion.

Eight roentgenograms; 1 photomicrograph.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Growth of the Heart Related to Bodily Growth During Childhood and Adolescence. Marion M. Maresh. Pediatrics **2:** 382–404, October 1948.

As part of a longitudinal study of 128 healthy children by the staff of the Child Research Council (Denver), roentgenograms of the chest were made at frequent intervals over a period of years; three cardiac diameters (transverse, long, and broad) and the internal diameter of the chest were measured on each of 3,205 of these films. The size and shape of the heart are illustrated and discussed, with emphasis on the range of variation seen in healthy individuals and on the inadequacy of one set of "normal standards" for evaluating the cardiac silhouette.

In spite of fluctuations in the growth curves for the cardiac diameters, a general agreement was found in the increases in these diameters and the increases in body height and weight during childhood and adolescence. It would seem that periods of rapid growth, such as are usually seen in adolescence, are frequently coincident with fairly rapid increases in the cardiac diameters, suggesting that cardiac demands are greater during such growth spurts.

The mean values for transverse diameter of the heart showed the same type of sex differentiation that is found in the mean values for height and weight in boys and girls. It seems logical to assume that changing cardiac size should be considered as part of the growth process rather than an isolated physical and physiologic process.

The apparent relationship between transverse diameter of the heart and height, weight, and internal diameter of the chest could not be proved statistically by calculated coefficients of correlation. It was possible, however, to show differences in the mean values for cardiac transverse diameter in three groups, classified as to height-weight relationships into overweight, medium-weight, and underweight individuals. The mean values were greatest for the fat group and least for the thin group. Body build may, therefore, be a factor in determining cardiac size during childhood as well as during adolescence and adult life.

Since the width of the chest is increasing during childhood and adolescence in much the same manner that the transverse diameter of the heart is increasing, cardiothoracic ratios do not become progressively greater with advancing age. In fact, the successive ratios on the same individual show little regularity toward either increase or decrease, although mean values for the different ages do decrease from a high of 0.44 at four years of age to a low of 0.40 in the post-adolescent age groups. Each individual showed considerable fluctuation in the cardiothoracic ratios but no one person fluctuated as much as the range for the whole group. No ratios were found above 0.50 or below 0.32. No sex differences were found, nor was there any significant difference in the cardiothoracic ratios for the groups of different height-weight proportions. In evaluating the heart size of an individual from a single film, the cardiothoracic ratio is probably as satisfactory as any other measurement if one recognizes the wide range of healthy variation. An increase in the ratio on successive roentgenograms might be more significant clinically than cardiac measurements which did not take into consideration the growth of the individual.

Ungerleider's nomogram based on height and weight for prediction of transverse diameter of the heart on roentgenograms of adults (Am. Heart J. **24:** 494, 1942. See also Radiology **48:** 129, 1947) was tested for its applicability to the later childhood, adolescent, and early adult periods, and it was found that nearly half the predicted cardiac transverse diameters exceeded the measured values by 10 per cent or more.

This study would seem to indicate, therefore, that one should not be discouraged by the range of variation or the fluctuations in cardiac measurements from routine roentgenograms of the chest. Valuable information regarding the significance of the size of the heart can be obtained from such films if one relates the data to the basic process of growth and maturation of the individual.

Forty roentgenograms; 8 tables; 12 charts.

Clinical Application of Angiocardiography. Henry K. Taylor. Dis. of Chest **14:** 707–721, September-October 1948.

Visualization of the heart chambers and large vessels with contrast substance permits a demonstration of the normal and abnormal anatomy, reveals congenital anomalies, and aids in the differentiation of vascular from non-vascular mediastinal lesions. This procedure may also be used to demonstrate: (1) the veins in the upper extremity; (2) character of the pulmonary circulation; (3) collateral circulation attending obstructing lesions at the thoracic inlet; (4) morphologic changes in the large afferent and efferent vessels of the heart; and (5) the thoracic and abdominal portions of the aorta.

Five case histories with illustrations are included demonstrating an aneurysm of the aortic arch, a superior mediastinal mass which proved to be an aneurysm of either the innominate or common carotid artery, a posterior mediastinal mass which proved to be a poststenotic segmental dilatation in the descending aorta, anomalous origin of the innominate and common carotid arteries in a case of coarctation of the aorta, and a nonvascular pulmonary lesion.

Illustrations demonstrating congenital anomalies in three infants are also included through the courtesy of Dr. A. Castellanos of Havana. They are (1) a right and a left superior vena cava, (2) an aneurysmal dilatation of the pulmonary aorta and left pulmonary artery, and (3) a tetralogy of Fallot.

Historical data, technic, and reactions to the procedure are discussed.

Twenty-three roentgenograms.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Venous Catheterisation of the Heart. I. Results on Normal Subjects. B. van Lingen and M. R. Becklake, with assistance of I. Segal. South African M. J. **22:** 575–584, Sept. 25, 1948.

The findings on venous catheterization of the hearts of 8 normal subjects are presented. They agree well with the results given by other investigators. The catheter was advanced under fluoroscopic control and films were made to record the position of the catheter tip when samples were drawn. About 10 samples of blood were removed under oil and the oxygen content was measured. An average value was assigned for the arterial oxygen saturation instead of doing arterial punctures.

The authors were attempting to show that satisfactory results can be obtained without complicated research instruments, which are available in very few

places. A mathematical method is given for deriving the systolic and diastolic pressures from the mean pressure (the only pressure which the simple saline manometer can record). It depends on the observed fact that the mean right auricular pressure is the same as the diastolic pressure of the right ventricle.

The technic is discussed fully, and anyone interested in the subject should read the original article.

Nine roentgenograms; 1 drawing; 4 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Pathogenic Analysis of Black Cardiopathy (Ayerza's Disease). João Porto. Schweiz. med. Wchnschr. **78:** 913–920, Sept. 25, 1948. (In French)

The two principal symptom elements of the "black cardiac," the cyanosis and the asystole, have a different origin. (Asystole appears here to be used with the more correct meaning of an imperfect or incomplete contraction rather than an absent one.) Even though the condition originates on the basis of a chronic bronchopneumonia, there are forms in which the cyanosis is intense and the cardiopathy slight and others in which severe cardiopathy is accompanied by little or no cyanosis. This relation depends on the severity of the alveolar lesions, the presence of infarctions or zones of atelectasis; cyanosis is directly caused by the decrease in the extent of the alveolar bed. Cardiac dilatation, on the other hand, is related to the sclerosis and reduction of the capillary bed of the lesser circulation. The basic cause thus differs from the exciting factors, and the fatigue and dyspnea, commonly attributed to the cardiac insufficiency, are in fact due to respiratory insufficiency. The cardiac implications of this factor involve the whole heart, not merely the right side, and are due to the anoxemia and the hypercapnia with a secondary increase in the cardiac work load. When the interstitial sclerosis reaches a degree sufficient to cause changes in the form, volume, and function of the right ventricle, it will also have reduced the alveolar field and its capacity for ventilation, which will in turn lead to cyanosis, generally intense, and to congestive failure. The author favors the adoption of the term "cyanotic bronchopneumopathy" to describe the condition.

Nine illustrations, including 4 roentgenograms.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

THE DIGESTIVE SYSTEM

Spontaneous Rupture of the Esophagus. Thomas J. Kinsella, Russell W. Morse, and Ambrose J. Hertzog. J. Thoracic Surg. **17:** 613–631, October 1948.

More than 50 cases of spontaneous rupture of the esophagus have been reported since the first case was recorded in 1724. In most of these the diagnosis was made post mortem. The typical clinical picture is that of an apparently healthy individual, a heavy eater and often addicted to alcohol, who suddenly experiences excruciating pain, usually epigastric, extending through the left chest to the back, in association with vomiting. Collapse, shock, dyspnea, and cyanosis follow. The vomiting usually ceases and intense thirst develops. In 60 per cent of the cases emphysema occurs in the tissues at the base of the neck. A hydropneumothorax usually occurs.

The earliest and most constant roentgen finding is mediastinal emphysema. The next most important is a fluid level in the mediastinum and the third is a pneumothorax, usually on the left—though it may be bilateral—later becoming a hydropneumothorax. If further confirmation is necessary, the esophagus can be examined with a small amount of barium or iodized oil. Aspiration of stomach contents from the pleural cavity is also diagnostic if one is certain the aspirating needle was not inserted directly into the stomach.

Heretofore these patients have been considered hopeless, particularly so far as surgical procedures are concerned. The authors, however, advocate immediate operation and closure of the rent in the esophagus. Many other steps are included in the treatment, such as transfusions, chemotherapy, aspiration of a tension pneumothorax, and discontinuation of all fluids by mouth.

A summary of the world's literature, including the 5 cases reported in this article, shows that in only 14 patients has the diagnosis been made during life; 5 of these have been operated on, with 2 recoveries. Only one of the authors' patients was operated on and he died on the ninth postoperative day from pulmonary embolism.

This is a good article with an extensive bibliography.

HAROLD O. PETERSON, M.D.
University of Minnesota

Spontaneous Rupture of the Esophagus: Report of One Case, with Recovery. Julian A. Moore and James D. Murphy. J. Thoracic Surg. **17:** 632–638, October 1948.

A 33-year-old male with sudden severe left epigastric pain and bloody vomiting was operated upon for a perforated peptic ulcer, but none was found. A hydropneumothorax developed and when gastric contents were aspirated from the left pleural cavity the diagnosis of ruptured esophagus was made fifteen days after the onset of symptoms. Thoracotomy drainage was instituted and a jejunostomy was done for feeding. Forty-one days from the onset the patient was operated on, and the hole in the esophagus was closed by means of an esophagogastroplasty. Recovery was complete.

This patient also had a large esophageal hiatus and evidently had a hiatus hernia at times, although at operation the stomach was found below the diaphragm. Several films are reproduced, some of which seem to have been misinterpreted. The authors question the wisdom of immediate repair of the esophagus.

HAROLD O. PETERSON, M.D.
University of Minnesota

Congenital Tracheoesophageal Fistula Without Esophageal Atresia. Cameron Haight. J. Thoracic Surg. **17:** 600–612, October 1948.

Congenital tracheoesophageal fistula without atresia is a rare occurrence. It has been found in only 2 of 65 cases of anomalies of the esophagus at the University of Michigan Hospital. The patients have chronic cough, choking spells during or after eating, attacks of cyanosis and vomiting, and repeated respiratory infections.

The most important point in the roentgen examination is to inject lipiodol into the esophagus with the patient in the prone position. Otherwise the oil may not pass into the trachea. Esophagoscopy and tracheoscopy are also important in establishing the diagnosis.

Only two cases are reported which have been operated on. One of these is included in this article with a de-

tailed description and reproductions of several roentgenograms. The patient was four years old at operation.

HAROLD O. PETERSON, M.D.
University of Minnesota

Diverticula of the Thoracic Esophagus. Herbert D. Adams. J. Thoracic Surg. **17:** 639–645, October 1948.

In the presence of diverticulum of the thoracic esophagus, the symptoms are due to a slowly progressive mechanical obstruction. All the cases reported in this paper were of the pulsion type, in the lower third of the esophagus. Traction-type diverticula are usually found in the middle third of the esophagus and do not attain sufficient size to produce symptoms.

The first 3 patients in the series of 5 were operated on before penicillin was available. Consequently the diverticula were not excised but were elevated and fixed so that food could no longer enter into the pouch. The last two cases were more recent and the diverticula were totally excised. In all the patients symptoms were relieved. Roentgenograms of all the cases are reproduced, with short clinical histories.

HAROLD O. PETERSON, M.D.
University of Minnesota

Roentgen Examination of the Stomach in Symptomless Persons. Leo G. Rigler. J. A. M. A. **137:** 1501–1507, Aug. 21, 1948.

Some means must be devised so that carcinoma of the stomach may be detected when the lesion is small and operable; therefore diagnosis must be made before appreciable signs and symptoms have occurred. X-ray examination is the only method which appears universally applicable and reasonably accurate in the routine examination of the stomach. However, since the incidence of carcinoma of the stomach is only 3 per 1,000 among persons over fifty, the productivity of such examination must be expected to be low.

The author suggests the following criteria in order to select persons in whom a higher incidence of carcinoma of the stomach will be found: (1) age over fifty; (2) family history of cancer of the stomach, pernicious anemia, or achlorhydria; (3) atrophic gastric mucosa, usually diagnosed by gastroscopy; (4) gastric ulcer; (5) occult blood in the stool; (6) achlorhydria and hypochlorhydria; (7) pernicious anemia; (8) polypi—not a practical approach since these are usually diagnosed by roentgen examination.

In 544 symptomless persons over the age of fifty whose gastric contents showed either achlorhydria or free hydrochloric acid of less than 30 units, 3 carcinomas of the stomach and 19 presumably benign polypi were discovered by routine roentgen examination.

The author does not advocate general mass gastrointestinal surveys at the present time, but believes that a number of pilot experiments going on in several institutions may be desirable. (Such a pilot study is recorded in the following abstract.)

Eight roentgenograms.

E. E. BREYFOGLE, M.D.
University of Michigan

Gastric Carcinoma: Its Etiology, Symptoms and Treatment. David State. Minnesota Med. **31:** 1080–1086, October 1948.

The author discusses the incidence and etiology of gastric cancer and, like others, stresses the silent character of the early lesion and the need of some means of discovering those persons who are harboring the disease in a symptomless stage or in whom it is likely to develop. With this in mind, roentgen studies were made of the following groups at six-month intervals: (*a*) patients over fifty, free of digestive complaints, with achlorhydria or hypochlorhydria; (*b*) patients with gastric polyps; (*c*) patients with pernicious anemia; (*d*) patients with an unexplained hemoglobin level of 11 gm. or lower; (*e*) patients with occult blood in the stools; (*f*) relatives of patients with gastric carcinoma.

By limiting studies to these "precursor" groups, the authors have interposed an effective filter for the selection of those persons most likely to have gastric carcinoma. Thus, in 1,218 roentgenograms obtained (July 1, 1945–Oct. 1, 1947), representing 752 persons, 5 unsuspected carcinomas and 33 gastric polyps were discovered. These figures are compared with the much lower ones of St. John, Swenson, and Harvey (Ann. Surg. **119**: 225, 1944. Abst. in Radiology **46**: 200, 1946) and of Dailey and Miller (Gastroenterology **5**: 1, 1945. Abst. in Radiology **46**: 617, 1946), who for their surveys used no other criterion than age.

The problems of treatment are discussed at length.

This paper comes from the same institution (University of Minnesota Hospitals) as that abstracted immediately above.

Seven tables.

Distinctions Between Gastric Sarcoma and Carcinoma, with Special Reference to the Infiltrating Types of Sarcoma. Anthony Bassler and A. Gerard Peters. J. A. M. A. **138**: 489–494, Oct. 16, 1948.

Twenty cases of proved gastric sarcoma were analyzed from the standpoints of history, physical signs, laboratory and x-ray findings, and gastroscopic observations, to obtain some criteria for distinguishing between carcinoma and sarcoma of the stomach preoperatively.

No one pathognomonic sign or combination of signs was found, but certain significant points stand out. In sarcoma the average age was fifteen years less than in carcinoma, though the range was just as wide. Sex distribution was the same as for carcinoma, males predominating. In sarcoma the duration of symptoms was considerably longer, apparently because of slower growth and because the orifices were seldom obstructed. No relationship between peptic ulcer and sarcoma was found.

Weakness was a symptom in less than half as many cases of sarcoma as carcinoma, while loss of weight averaged about one-third of that in carcinoma. Jaundice was not seen in any of the sarcoma cases; it is present in nearly one-fourth of all cases of gastric carcinoma.

In sarcoma, palpable tumors are only half as common as in carcinoma and tend to be vague and doughy, in contrast to the firm, easily palpable carcinomatous masses.

Fifteen per cent of sarcoma cases show splenic enlargement, a feature not found in carcinoma. Virchow's node is not seen in sarcoma. Achlorhydria is present in only 25 per cent of the cases, a much lower figure than for carcinoma.

Blood in the stools or gastric contents is only one-third as common in sarcoma as in carcinoma, simply because the mucosa is invaded late, while carcinoma arises in the mucosa.

Gastroscopy was less accurate in sarcoma than in carcinoma, probably for the same reason that bleeding does not often take place. X-ray examination is also less valuable than in carcinoma, but is still considered the most reliable method of diagnosis available. In the authors' series of 20 cases the x-ray findings were interpreted as suggestive of sarcoma in 11. (It is not stated whether the others were all labeled as other lesions or even if they were examined.) One case is mentioned which was called sarcoma but proved to be a colloid carcinoma.

The roentgen findings indicative of sarcoma are: (1) a well-defined endogastric mass, not pedunculated (or easily movable) and usually with an ulcer niche; (2) tumor on the greater curvature; (3) giant rugae (especially in lymphosarcoma, which accounts for 60 per cent of all cases of sarcoma of the stomach); (4) diffuse decrease in the size of the stomach; (5) absent or few "thumb indentations" characteristic of carcinoma—the deformity in sarcoma usually consisting of shallow serrations over a large part of the stomach, and (6) preservation of peristalsis in some cases even though a large part of the stomach is involved. This last finding is seen in lymphosarcoma where the process arises in the submucosa and does not involve the muscularis until late.

This tabulation of findings is important, since it is of more than academic interest to distinguish between carcinoma and sarcoma. If sarcoma is at least suggested preoperatively, frozen section can be done to determine the diagnosis in the operating room. Leiomyosarcoma, spindle-cell, and other types, of course, require resection, but biopsy and postoperative x-ray therapy is the treatment of choice for lymphosarcoma.

Five roentgenograms; 1 photomicrograph; 2 tables.

ZAC F. ENDRESS, M. D.
Pontiac, Mich.

Multiple Carcinomas of the Stomach and Choledocholithiasis in a Patient with Pernicious Anemia. Harry B. Neel. Minnesota Med. **31**: 1077–1079, October 1948.

A case is reported which provides further evidence of tendency to the development of carcinoma of the stomach in patients with pernicious anemia and of the importance of periodic (semi-annual) roentgen examinations of the gastro-intestinal tract in this group. The patient had a well-established pernicious anemia of twelve years duration and three distinct adenocarcinomas of the stomach. The presence of a common-duct stone was coincidental.

One photograph.

Vagotomy for Peptic Ulcer: A Follow-up Study of Twenty Cases. Robert C. Lam. Minnesota Med. **31**: 1100–1105, October 1948.

In a follow-up study of 20 patients undergoing vagotomy for peptic ulcer the x-ray findings in the stomach and duodenum, on the whole, corresponded closely to the patient's state of health and these objective findings are therefore taken as reliable criteria in the evaluation of the results.

Evidence of active duodenal ulcer, which was found roentgenologically in 17 patients before operation, was absent in all 17 after vagotomy. Deformity of the duodenal cap was as constant a feature after as before the operation, whereas irritability and spasm of the cap was present in 5 patients before but in none after vagotomy.

In the stomach, hypertrophic gastritis, which was encountered in 8 patients preoperatively, disappeared after operation. A lesion at the pylorus, in the form of spasm, irregularity, deformity, adhesion or obstruction, was present in the 3 patients with gastric ulcer. It disappeared with the ulcer after vagotomy and gastro-enterostomy in 2 patients, but persisted with the ulcer after simple vagotomy in the third. Another patient with a partially obstructed pylorus without ulcer showed deformity after simple vagotomy.

In the group with simple vagotomy, there was a tendency towards initial retention of secretion and food, delayed emptying, decreased tone, dilatation, and reduced peristalsis postoperatively. A decrease in gastric motility was apparent in 5 patients before and in 13 patients after simple vagotomy. In the group with vagotomy and gastro-enterostomy, no such appreciable change was noted.

In 5 patients where more than one x-ray examination was made following simple vagotomy, there was a gradual improvement or return of the gastric motility, and in 1 patient the gastric motility which had been decreased before the operation became normal postoperatively.

Six tables.

[See Furey: "X-Ray Observations Before and After Vagotomy. Radiology **51**: 806, 1948.—Ed.]

Gastrointestinal Motility Following Vagotomy and the Use of Urecholine for the Control of Certain Undesirable Phenomena. Thomas E. Machella and Stanley H. Lorber. Gastroenterology **11**: 426–441, October 1948.

The gastro-intestinal tract has two systems of innervation, which are generally believed to be antagonistic. The parasympathetic is excitatory to smooth musculature, except the sphincters, while the sympathetic has a reverse effect. The vagus supplies parasympathetic innervation down to and including the proximal half or third of the transverse colon. Its section has been found experimentally and clinically to be followed by motor disturbances, such as gastric dilatation, delayed emptying of the stomach, and changes in the motility of the small bowel.

The authors report the results of roentgen examination, balloon-kymographic examinations, and the insulin test in 26 patients who had undergone vagotomy, either with or without some form of anastomosis.

In 9 out of 10 cases in which vagotomy alone was done, troublesome symptoms of gastric retention developed. In these, x-ray examination showed a decreased tonus of the antrum and absence or great diminution of antral peristalsis. Roentgen studies also showed a delayed transit time of barium from the pylorus to the cecum. In 7 of the 9 cases small doses of urecholine caused a marked decrease in symptoms. In the other two a complicating factor, ulcer at the pylorus, prevented satisfactory treatment with urecholine and surgery had to be resorted to.

In 16 patients with vagotomy and gastro-enterostomy, there were 3 instances of gastric retention. In 2 of the 3, where there was an obstruction of the efferent loops of the jejunum, urecholine was not effective. The drug emptied the stomach by the normal outlet but the barium returned through the stoma.

In 1 case a dysphagia developed after vagotomy and

was not amenable to urecholine or atropine, but eventually disappeared spontaneously.

Nine roentgenograms; 3 charts; 1 table.

JOSEPH T. DANZER, M.D.
Oil City, Penna.

Benign Ulcer of the Greater Curvature of the Stomach. G. R. Kennedy and Erwin Beck. Am. J. Surg. 76: 429–433, October 1948.

A proved case of benign ulcer of the greater curvature of the stomach, 5.5 cm. proximal to the pylorus, is reported. The preoperative roentgen diagnosis was "ulcer of the greater curvature, probably malignant," but histologic study showed only chronic granulation tissue, fibrosis, and infiltration with chronic inflammatory cells.

Because of the extreme rarity of benign ulcers of the greater curvature of the stomach such lesions should be considered malignant until proved otherwise.

One roentgenogram; 1 photomicrograph.

VERN W. RITTER, M.D.
University of Pennsylvania

Duodenal Ulcer—A Follow-up Study of 305 Veterans Discharged Because of Ulcer. Allen E. Hussar. Gastroenterology 11: 183–199, August 1948.

This paper is based on a review of 305 veterans who were discharged from service because of duodenal ulcer. An average of thirty-four months had elapsed since the date of discharge, and during this time 5 had undergone operation: 1 vagotomy and 4 partial gastric resection. Only the 300 medically treated cases are submitted in the analysis, which takes into account the time interval between induction and onset of symptoms, per cent free of symptoms since separation, number improved, unimproved, etc.

In the follow-up examinations, only 6 per cent of the group of 300 stated that they had been completely free of symptoms since separation from service. X-ray examination revealed an ulcer crater in 22 per cent, irritable bulb in 11 per cent, deformed bulb in 41 per cent, and negative findings in 26 per cent. From the roentgen findings and symptoms, the ulcer was diagnosed as active in 68 per cent of the group and inactive in 32 per cent.

Improper ulcer life was believed to play an important part in the results. While 85 per cent of the patients believed that they were following their dietary regulations, only 19 per cent could be classified as observing these properly, and 33 per cent as "fairly properly." Since separation from service 57 per cent had had no medical care; 36 per cent had gone to see a doctor occasionally; only 7 per cent had been under continuous medical supervision.

Only one case of perforation occurred during the observation period; there were 14 instances of massive hemorrhage (5 per cent).

Physical and roentgen findings are correlated in the tables. The incidence of activity, recurrences, and intractability are discussed at length.

Four tables.

ALTON S. HANSEN, M.D.
Peoria, Ill.

Surgical and Roentgenologic Aspects of Duodenal Diverticula. James G. Conti, Thomas P. Foltz, and G. Arnold Stevens. J.A.M.A. **138**: 403–405, Oct. 9, 1948.

Duodenal diverticula are rather frequently found in examining the stomach and duodenum by barium meal. They are usually considered an incidental finding but occasionally they become inflamed and give rise to symptoms. Pain and fullness after eating seem to be the only constant subjective findings and perhaps some patients with diverticula are wrongly labeled as psychoneurotic.

The roentgen manifestations of a duodenal diverticulum are essentially the same as those of diverticula elsewhere in the alimentary tract, an outpouching, usually from the mesial wall of the second portion of the duodenum connected with the intestine by a stalk. Twenty-four- and forty-eight-hour studies may show retention of barium in the sac. The author mentions several conditions as calling for consideration in differential diagnosis—pseudo or prestenotic diverticulum, localized distention, malignant and benign tumors—but actually nothing else really looks like a diverticulum.

Three cases are reported in which surgical extirpation gave relief. One of the cases was of unusual interest, because the diverticulum contained an active ulcer in its base and because it occurred in the third portion of the duodenum. The point is made that in some cases the surgeon must open the duodenum before he is able to find the diverticulum.

Four roentgenograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Early Diagnosis and Roentgen Manifestations of Obstruction of Small Bowel. Claude J. Hunt. Arch. Surg. **57**: 460–469, October 1948.

The principal physical signs of bowel obstruction are pain, peristalsis, and borborygmus. Proper evaluation leads to a diagnosis fairly readily. Strangulation is less easily recognized, but an evaluation of a roentgenogram of the abdomen may be of great help in determining this point, which in turn determines whether immediate operation or delay for physiologic rehabilitation and bowel decompression is indicated. Gas can be demonstrated in the small bowel a few hours after the onset of obstruction. The important diagnostic points are the relation of the loops to the long axis of the body, and the presence or absence of valvulae conniventes. In a simple obstruction the bowel lies in transverse loops—the "step-ladder pattern"—and valvulae are visible; when this pattern is present, the blood supply is intact. If the distended loops assume no definite pattern, with irregular distention and absence of the valvulae, strangulation is indicated. In the rare event the patterns coexist, strangulation must be diagnosed. In ileus, there is uniform dilatation of the large and small bowel, as contrasted with small bowel obstruction in which the large bowel is not distended. The use of a Miller-Abbott tube is limited, and although it is excellent for a restricted field it should never be used in a strangulated obstruction.

Six roentgenograms; two photographs.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Acute Volvulus of the Small Bowel. Clivio V Nario. Prensa méd. argent. **34**: 1847–1851, Sept. 26, 1947. (In Spanish)

Acute volvulus of the small intestine occurs more frequently than is generally appreciated and the mortality is high. The volvulus may be total or partial, the partial cases going on to total volvulus if not treated. Total volvulus may include the entire jejunum and ileum, though this is a rare event.

Volvulus of the small bowel includes two parts: the dilated loop and the loop lying immediately above it. The distended loop exhibits all the characteristics and consequences of ileus due to strangulation. The supravolvular loop is the site of ileus due to the obstruction superimposed on the volvulus itself. The importance, the severity, and the extent of the two components and their clinical manifestations may vary considerably.

The diagnosis cannot be made surely without x-ray study, which therefore becomes the fundamental examination in all cases. But, while the radiological findings may assure the reality of the obstruction, they do not always indicate the cause.

The use of the Miller-Abbott tube is contraindicated in volvulus of the small bowel because of the delay, the danger of strangulation, impossibility of progression if the duodenum participates in the volvulus, and because of aggravation of the volvulus by hyperperistalsis set up by the tube. JAMES T. CASE, M.D.
Chicago, Ill.

Nonspecific Enterocolitis. Edwin S. Olsan and Marcy L. Sussman. Am. J. Roentgenol. **60**: 471–485, October 1948.

All cases of ulcerative colitis and regional enteritis are by no means identical, as shown by the series of cases here reported. A number of colitis patients have involvement of the terminal ileum and some have extensive involvement of the ileum and even the jejunum. One of the cases presented seems to be best classified as non-specific enterocolitis but might be a variant of either granulomatous enteritis or ulcerative colitis. Other cases seem to be typical instances of chronic ulcerative colitis with exceptionally extensive involvement of the small intestine. Three cases were complicated by amyloidosis.

X-ray appearance of small bowel stenosis in these diseases is not necessarily due to fibrosis, for in some cases it has been seen to disappear. The narrowing is presumably due to edema and infiltration of the bowel wall.

The etiology is unknown and treatment presents a serious problem. All of the cases reported in this article had a fatal outcome.

Nine roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Localized Rectosigmoidal Ulcerative Colitis. Manuel M. Ramos Mejia and Carlos A. Gallastegui. Prensa méd. argent. **35**: 411–414, March 5, 1948. (In Spanish)

The grave form of colitis is characterized fundamentally by involvement of the large bowel in its entirety, by its progressiveness, by the intense repercussions on the general state, and by rebelliousness to all therapeutics, including surgery. It is this form which the authors found in 75 per cent of their patients.

The present communication discusses the form of ulcerative colitis which the authors call "segmentary rectosigmoidal colitis ulcerosa." The patients present a clinical picture of rectosigmoid disease with an acute onset, very severe diarrhea with blood, mucus, and pus, intestinal colic, straining and tenesmus, and an endoscopic picture typical of ulcerative colitis—hyperemic, fragile, easily traumatized mucosa, with microscopic ulcerations and abscesses but with the peculiarity that these findings do not extend higher than the sigmoid. In these cases the general state has been little or not at all affected, unless occasionally there has been a discrete anemia of microcytic type. Usually the history dates back two to two and a half years, sometimes a few months, or even as long as eight years.

This type of segmented ulcerative colitis, having more or less benign characteristics because of its favorable response to treatment, does not begin to offer the gravity of generalized ulcerative colitis. Little or nothing is known of its etiology. The authors think that it must be a non-specific reaction of the large intestine to bacterial, toxic, anaphylactic, and other aggressions. A number of roentgenograms of illustrative cases are included. JAMES T. CASE, M.D.
Chicago, Ill.

The Secondary Infection in Chronic Amoebic Colitis. A Clinicopathological and a Radiological Study. A. M. Beemer, Eric Samuel, and A. Shedrow. South African M. J. **22**: 612–624, Oct. 9, 1948.

The authors present their views on the importance of secondary invaders in the symptomatology of chronic amebic colitis. The paper is divided into two major portions, dealing, respectively, with clinicopathological features and radiographic features. Five case histories are presented. The pathological findings and clinical symptoms are felt to be largely due to secondary organisms, although Entamoeba histolytica causes the original lesion.

Complete radiological investigation of the large bowel is an integral part of the diagnosis of chronic amebiasis. The authors favor examination with the barium enema as affording the more valuable evidence. Changes in the contour of the cecum and of the transverse and ascending colon are commonly encountered. The normal sac-like appearance of the cecum is replaced by a gradual narrowing of the cecal walls producing a cone-like form, which has been referred to as "funnelling." Elsewhere in the colon areas of localized narrowing and a shaggy irregular outline are demonstrable. Disturbed motility of the colon is usually observed as a persistent local spasm. An incompetent patulous ileocecal valve is also an important finding. Changes in the mucosal pattern are frequently seen and in severe cases cannot be differentiated from the later phases of ulcerative colitis. Tumor-like masses similar to malignant tumors are described in some cases. These clear up under the proper therapy.

The radiological contributions to the diagnosis of amebiasis are summarized as follows:

(*a*) Radiology has little or no place in the acute stage of amebic dysentery.

(*b*) In chronic amebic colitis it may be of utmost importance when the clinical picture and bacteriological examination do not establish a diagnosis.

(*c*) In chronic cases diagnosed by other means, radiological examination is still of value in determining the extent of the colonic lesions and as a means of controlling the effects of treatment.

Nine roentgenograms; 1 photomicrograph; 2 tables.
D. R. BRYANT, M.D.
The Henry Ford Hospital

Visceral Neuropathy Complicating Diabetes Mellitus. Jerome M. Swarts and Leonard A. Stine. Am. J. Med **5**: 610–615, October 1948.

The case of a 33-year-old male who presented the typical picture of diabetic neuropathy is reported. The

diabetes had been under poor control for many years. In addition to the more common neurologic signs and symptoms, there were impaired intestinal motility, neurogenic bladder, impotence, and orthostatic hypotension.

The occurrence of disordered motor function of the gastro-intestinal tract in diabetic neuropathy has only occasionally been recognized. The roentgen findings are the same as in other conditions associated with malnutrition, such as steatorrhea, consisting of (1) hypermotility and hypertonicity; (2) hypomotility and hypotonicity, later; (3) segmentation; (4) scattering effect; (5) delayed gastric evacuation.

Therapeutic measures, including transurethral resection of fibrous non-vascular tissue in the region of the posterior urethra, control of the diabetes with insulin, a diet adequate in calories and in protein content, and prostigmine (later replaced by oral mecholyl bromide), brought about a gratifying degree of clinical improvement in the case reported. Emphasis is placed upon early recognition and treatment.

Three roentgenograms.

Megasigmoid. Clinical and Surgical Considerations in Thirty-six Cases. Abel N. Canónico and Federico R. Pilheu. Prensa méd. argent. **35:** 484–498, March 19, 1948. (In Spanish)

The authors report 36 cases of megasigmoid encountered in the Institute of Clinical Surgery of Buenos Aires between 1919 and 1947. In these cases the colonic malformation was fundamentally limited to the sigmoid, except for a few patients who presented a megarectum. Since the Institute of Clinical Surgery is predominantly a surgical center, only the most advanced cases were referred to it. Rarely was a patient treated in an early stage. Sixty-six per cent of the patients were between thirty and sixty years of age, and three quarters of them were males.

The radiologic findings are considered of great importance in determining the extent and severity of the colonic dilatation. Both the opaque meal and the opaque enema were used, but the latter is considered preferable since the ingested material was often insufficient to visualize the dilated lumen completely. Occasionally the dilatation was most pronounced in one segment of the sigmoid, usually the distal portion.

The coexistence of megasigmoid with dolichosigmoid or with megarectum is relatively frequent. Fecalomas were found in about one-half of the cases. These were often visualized on the direct film without the use of contrast material. With the opaque material the fecalomas were recognized as large filling defects. [The authors do not mention the difficulties and complications of filling the dilated intestine with heavy contrast material as opposed to the injection of air, if necessary, to supplement the gas already present and thus visualize the dilated segment of the bowel.—J.T.C.]

Thirty-two illustrations, including 25 roentgenograms; 5 tables.

JAMES T. CASE, M.D.
Chicago, Ill.

Etiology and Diagnosis of Subphrenic Abscess. Harold T. Gross. Ohio State M. J. **44:** 1005–1008, October 1948.

Subphrenic abscess is rarely a primary condition. Its presence always suggests a suppurative process elsewhere in the body. In 84 per cent of the cases the primary cause is an intra-abdominal lesion. The greatest number occur postoperatively. The diagnosis is frequently overlooked and the mortality is high. Many routes of infection can be listed, but whatever way the condition arises, the manifestations are the same, namely, the general signs of an infectious process—chills, fever, prostration, etc. The local clinical signs of pain and tenderness may not be prominent, but the x-ray findings are constant and conclusive. They consist of elevation and immobility of the diaphragm on the affected side, fluid in the pleural cavity on the affected side, or an area of compression atelectasis of the lower lobe along the raised diaphragmatic border. Occasionally, a fluid level with a gas bubble above may be seen below the diaphragm, which indicates gas-forming organisms in an abscess cavity. Roentgenographic studies of the lumbar spine and the surrounding area are often of additional aid. The most frequent finding is a partial or complete obliteration of the psoas muscle shadow on the side of the abscess.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Lipogranuloma of the Peritoneum. Report of Three Cases Following the Intra-Abdominal Use of Liquid Petrolatum. William G. Whitaker, Jr., E. Thayer Walker, and Joseph Canipelli. J. A. M. A. **138:** 363–365, Oct. 2, 1948.

In the first two or three decades of this century it was considered good practice by some surgeons to introduce sterile mineral oil into the peritoneal cavity at the conclusion of an operation to prevent adhesions. Subsequently it was shown that these oils were intensely irritating, resulting in the late formation of granulomas and adhesions. The unfortunate consequences of the practice are demonstrated by 3 cases reported here, all of which showed recurrent obstructive symptoms over a long period, beginning one or two years after the instillation of liquid petrolatum.

In the first case, operation twenty-three years after the introduction of the oil revealed numerous dense adhesions and calcified nodules which, on histologic study, showed lipoid vacuoles and a foreign body reaction. The findings in the second case were similar. No biopsy specimen was obtained in the third case, but the history, the demonstration of dense opacities in the upper abdomen, and the presence of extensive adhesions led to the diagnosis.

The interesting feature of these cases from the standpoint of the roentgenologist is the calcification which occurred in many of the fibrotic nodules. The calcified lesions measured 1 to 3 cm. in diameter; some had a cystic appearance, others were serrated, and others mulberry-like. They were fixed in position and were scattered throughout the abdomen.

This article should be consulted in the original, for the illustrations. Once they have been seen, the condition will be readily recognized.

Four roentgenograms; 2 photomicrographs.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Recurrent Acute Pancreatitis: Observations on Etiology and Surgical Treatment. Henry Doubilet and John H. Mulholland. Ann. Surg. **128:** 609–636, October 1948.

The paper includes case histories of 20 patients, all of whom had signs and symptoms of recurrent pancrea-

titis. Serum amylase determinations during an attack usually showed a considerable elevation. Pancreatic function was studied by means of duodenal tube collection of pancreatic juice following intravenous administration of secretin. It was demonstrated by means of common duct "T" tube kymographs that N/10 HCl applied to the papilla of Vater induced spasm at the sphincter of Oddi. Administered morphine produced spasm in the duodenal wall. Operative cholangiograms are reproduced which have recorded these effects.

Treatment of these patients, many of whom had gallbladder disease, with previous cholecystectomy, consisted of sectioning the sphincter muscle. The results were almost uniformly good. The symptoms, which usually consisted of frequently recurring attacks of severe epigastric pain, radiating to the back and left upper quadrant, accompanied by fever and leukocytosis, and lasting from one to several days, were relieved, and many patients who had become chronically incapacitated returned to useful occupations following the operation.

It is evident that in such patients, there is an anatomic variation in the entrance of the main pancreatic duct into the duodenum which creates a common biliary-pancreatic passage way, thus permitting bile to flow into the pancreas. A stone lodged in the ampulla of Vater, or spasm of the sphincter of Oddi, completes the set of conditions necessary for the diverting mechanism.

It has been observed that some temporary relief in patients suffering with recurrent acute pancreatitis has been obtained by removing the functioning gallbladder. It is offered as explanation that the concentrated bile from the gallbladder is probably an injurious chemical agent to the pancreas. It is not explained how bile can enter the pancreatic duct against the secretory pressure of the pancreas itself.

Thirty-seven illustrations, including 29 roentgenograms.

ALTON S. HANSEN, M.D.
Peoria, Ill.

Primary Carcinoma of the Liver in a Boy Aged 15. A. E. Beynon. Lancet **2:** 528–530, Oct. 2, 1948.

A case is reported of a primary carcinoma of the liver detected in a 15-year-old school boy during a mass miniature radiologic survey. X-ray examination revealed two clearly defined tumors in the lower lobe of the right lung. The remainder of the lung fields were clear. An apparently malignant tumor of the liver was found on clinical examination. Aspiration biopsy confirmed the diagnosis.

The boy led a normal symptomless life for about a year, but then his condition rapidly deteriorated, and he died about sixteen months after the original radiologic examination. There was no jaundice, and the metastases in the lung increased but slightly.

Three roentgenograms.

Problems in the Diagnosis and Treatment of the Non-Calculous Gall Bladder. Harry L. Segal, Harold A. Friedman, and James S. Watson, Jr. Am. J. Digest. Dis. **15:** 325–331, October 1948.

The gallbladder is part of a system by which dilute bile from the liver reaches the duodenum in concentrated form. Its main function is to concentrate and store bile for the ultimate purpose of digestion. Disturbances in this function may be caused externally by congenital or inflammatory bands and inflammation or tumors involving the pancreas or extrahepatic bile ducts. The internal causes of malfunction include congenital conditions, functional disturbances, infection, and disorders of the blood and metabolism.

Where the disorder is due to congenital bands, roentgenography may be of aid if it shows a small densely concentrated gallbladder, with no visualization of the cystic duct. In functional disorders, due to dyskinesia, the gallbladder fills well and shows normal concentrating power but evacuation is delayed. The gastrointestinal series will show irritability and possibly changes in the duodenal pattern. In the presence of infection, the gallbladder will show poor concentrating power.

Treatment will depend upon whether the malfunction is due to anatomical or physiological causes, and such a diagnosis is at times rather difficult to make. On the whole, the authors favor a thorough trial with medical treatment before resorting to surgery except in acute cholecystitis, where the question is not, "whether surgical intervention is indicated, but when."

JOSEPH T. DANZER, M.D.
Oil City, Penna.

THE MUSCULOSKELETAL SYSTEM

Estrogens and Bone Formation in the Human Female. Mary S. Sherman. J. Bone & Joint Surg. **30A:** 915–929, October 1948.

This paper discusses the effect of estrogens on recalcification of bone. It is based upon the history of a patient who seventeen years previously, at the age of thirty-seven, had undergone a panhysterectomy, for unknown reasons. At the age of fifty-four she noticed bowing of the right tibia, and six months later she fell and injured her right knee. A diagnosis of Paget's disease was made at that time. In the ensuing six months the patient sustained a series of fractures. On radiographic examination, the bones appeared extremely decalcified and greatly deformed. In the skull, however, there were areas of hypercalcification suggestive of Paget's disease. The case was extensively studied, with a final diagnosis of severe postmenopausal osteoporosis superimposed upon a previously existing widespread Paget's disease.

After administration of estrogenic substances, the patient improved rapidly, with healing of the fractures and recalcification of the bones. When, at one time, estrogen administration was interrupted, there was an exacerbation of symptoms. Resumption of the treatment was followed by marked improvement. At the time of the report, the patient had been kept for two years on daily doses of 2,000 to 10,000 rat units of estradiol benzoate. Improvement was maintained, and no untoward effects were observed.

Seven roentgenograms; 6 photomicrographs; 1 photograph; 1 chart.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Roentgen Appearance of the Hormonal Bone Diseases. H. Schinz, E. Uehlinger, and Ch. Botsztejn. Radiol. clin. **18:** 242–280, September 1948. (In German)

The forty pages of this extensive treatise on the roentgen diagnosis and roentgen therapy of hormonal disorders are not suitable for abstracting. It is a review of

all such diseases seen by the authors. The complicated mechanism of these disturbances is pointed out, and twenty-two syndromes are described, many of which occur in combination. It is impossible for a single individual to master this entire field. The American method of close co-operation of specialists seems the ideal way of obtaining an adequate diagnosis and treatment.

Six conclusions are reached for a systematic course of examination in such cases:

(1) Roentgenological-clinical-histological examination (often biopsy).
(2) Blood chemistry (calcium, phosphorus, phosphatase, serum-albumin).
(3) Urine examination (Sulkowitch test, 17 ketosteroid excretion, 11 oxide-steroid excretion).
(4) Metabolism (calcium, phosphorus, nitrogen).
(5) Follow-up of therapeutic measures (surgery, roentgen irradiation, or hormonal therapy).
(6) Evaluation of animal experimentation with hormones.

Chemists, anatomists, clinicians, radiologists, and surgeons all should be a part of this co-operating group. The truth of today is the error of tomorrow.

H. HEFKE, M.D.
Milwaukee, Wisc.

Acute Hematogenous Osteomyelitis. An End Result Study of Nonsurgical Treatment with Penicillin and Sulfonamides. Robert M. O'Brien and Joseph J. Mira. J. Missouri M. A. **45:** 754–758, October 1948.

A series of 24 cases of acute osteomyelitis were treated by chemotherapy with avoidance of surgery. Only one case in the entire series could be considered a failure and that was treated before penicillin was available. Soft-tissue abscesses were aspirated rather than opened and in most cases promptly healed. Six sequestra were seen, four of which were reabsorbed spontaneously; one was extruded spontaneously, and one was removed surgically.

Roentgen changes sometimes were not seen until the patients were clinically cured, so rapidly did some respond to treatment. The earliest signs were small areas of destruction at the ends of the diaphyses of the involved bones. Several cases showed only this sign and went on to complete healing with no evidence of the disease detectable in the end. Periosteal thickening was a later finding, occurring in 14 of the 24 cases.

The good results obtained were attributed to early and effective treatment.

Six roentgenograms; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Melorheostosis. H. A. Thomas Fairbank. J. Bone & Joint Surg. **30B:** 533–543, August 1948.

More than 40 cases of melorheostosis have appeared under various titles, in the literature, some of which the author regards as erroneous. He found only 4 unquestionable cases reported in England. In the recorded cases the age varies from five to fifty-four years. The etiology is unknown, but greatest support is given to the view that the condition is a developmental error, the result of "embryonic metameric disturbance."

Pain is the most common symptom, occurring in at least half of the cases. Limitation of movement of one or more joints of the affected limb is also found in about half of the cases and is more likely to occur late than early. It is due to excessive formation of dense bone in the immediate neighborhood of a joint and to the deposition of bone in soft tissues, rather than to actual distortion of the articular surfaces. Scleroderma, with fibrosis and thickening of muscles and other soft tissues, may be responsible occasionally for stiffness. Blood examination reveals nothing of importance.

In well marked cases roentgenograms show that some parts, and less commonly the whole, of certain bones throughout the length of the limb have the dense, structureless appearance of "marble bones." At first glance the "flow" of dense streaks and blotches—a flow which may be limited to part of a limb, and may be interrupted or continuous—seems to follow the distribution of a main vessel or nerve, even to the finger tips; but this does not bear closer investigation. It is common to see one side of a long bone escape, either for part or all its length, while the other side is dense and thickened. The skull, spine, and ribs almost invariably escape, but all were affected in Franklin and Matheson's unquestionable case (Brit. J. Radiol. **15:** 185, 1942. Abst. in Radiology **40:** 211, 1943) in which the right arm and leg were both the seat of typical changes, and which was remarkable in that the right half of the mandible was grossly thickened and very dense. No other case with involvement of the jaw has been reported.

Probably in most cases the bone changes are progressive, but this is not necessarily so.

Histologic reports, available in 9 cases, some of which are conflicting and not very helpful, indicate that dense areas are the seat of sclerosis, with compact overcrowding of lamellae arranged in a bizarre manner; there is an interlacing pattern of immature and adult bone. Concentric perivascular ossification is sometimes mentioned, and in 2 cases there was definite fibrosis of the marrow.

Diagnosis in a typical case is easy. Differentiation from osteopoikilosis is also easy, provided that the entire roentgenographic evidence is considered and undue attention is not paid to the appearance of one or two epiphyses. Osteopoikilosis is a general affection of the skeleton and it is not confined to one limb as melorheostosis usually is; moreover it is never associated with opacities in the soft tissues. Polyostotic fibrous dysplasia and Albright's syndrome may give an individual bone an appearance suggestive of melorheostosis, the fibrotic portion of the bone being unusually dense, not cystic, and having an abrupt outline; but in these two diseases the epiphyses, carpus, and tarsus are not affected, and the dense areas are not so dense and lacking in structure as in melorheostosis.

Four cases previously reported elsewhere are briefly presented.

Eleven roentgenograms; 1 photomicrograph; 4 drawings.

HUGH A. O'NEILL, M.D.
Cleveland, Ohio

Osteopoikilosis. H. A. Thomas Fairbank. J. Bone & Joint Surg. **30B:** 544–546, August 1948.

Like the article abstracted above, this paper is one from an Atlas of General Affections of the Skeleton, currently appearing in the British section of the *Journal of Bone & Joint Surgery*.

The characteristic feature of osteopoikilosis is the roentgen appearance of dense spots of varying size in many bones. The spots are circular, ovoid, or lanceolate, with the long axis parallel to the axis of the bone. They occur particularly in the epiphyses and adjacent parts of the metaphyses and are plentiful in the short bones of the tarsus and carpus, but have been found also in all the other bones of the body, though very rarely in the vertebrae, ribs, and skull.

On microscopic examination the spots are found to consist of numerous regularly arranged trabeculae of varying thickness. At the periphery they merge into surrounding cancellous bone.

The cause is unknown. The affection is symptomless and is discovered only by chance.

Two roentgenograms.

Hyperplastic Callus Formation, With or Without Evidence of a Fracture, in Osteogenesis Imperfecta, With an Account of the Histology. H. A. Thomas Fairbank and S. L. Baker. Brit. J. Surg. **36:** 1–16, July 1948.

In 1943 Brailsford, in an article on osteogenesis imperfecta (Brit. J. Radiol. **16:** 129, 1943. Abst. in Radiology **42:** 206, 1944) referred to a complication which he described as "a condition suggesting scurvy, subperiosteal hemorrhages being more frequent than fractures." It is the purpose of this paper to call further attention to this curious and obscure condition and to record the chief features in a group of 8 cases, including 2 of Brailsford's own.

The formation of callus after fracture in ordinary cases of osteogenesis imperfecta is usually, but not always, plentiful, and sometimes rather excessive, but the excess is absorbed in the normal way as consolidation occurs. Examination of the records of some 40 other cases of osteogenesis imperfecta has revealed none in which callus formation was in the least comparable with that seen in the series under discussion. The features displayed in this series are:

(*a*) Formation of intensely calcified local callus, not invariably preceded by a recognizable recent fracture.

(*b*) Excessive formation of ossified callus, which enveloped the shaft to a varying but quite unusual extent and in some cases displayed a strong tendency to result in permanent enlargement of the affected bone. Evidence of antecedent fractures of the affected bones was again not invariably present in the radiographs.

(*c*) Formation of bony excrescences on the shafts of the long bones, particularly on the interosseous borders and without the faintest sign of antecedent fractures.

Excessive early callus of unusual density was noted in 3 of the cases. Excessive formation of periosteal bone, usually starting from a fracture and therefore legitimately regarded as callus, was a definite feature in all but 1 case. Bony excrescences were present in at least 6 of the 8 cases. The radius and ulna were the bones most frequently affected, the shafts of these bones showing projections, usually on the interosseous border.

Other points worthy of mention in the series are the following: The age at which the cases first showed signs of a tendency to excess callus formation varied from one to fifteen years. Curvature of the bones and deformities of the limbs, the result of bending or fractures, were present in all cases, the legs and forearms being particularly affected.

As to treatment, apart from that called for by the fractures, all of the patients spent considerable time in children's hospitals, where they received an adequate diet. It is definitely known that two of the cases received intensive treatment to correct any possible deficiency of vitamin C over prolonged periods without appreciable effect on the condition of the bones.

In 2 of the cases biopsies were obtained of the callus which formed, and in each case essentially the same histologic features were present. The bulk of the material consisted of a fibromucoid, cartilage-like tissue. Histologically this is sometimes referred to as chondroid tissue. A detailed correlation of the x-ray findings and histology is presented.

It is clear that there is a definite relationship between excessive callus production and osteogenesis imperfecta. This excessive callus may follow a fracture or may occur with the bone apparently intact. It is limited to certain sites—most commonly the femur—and has developed on femoral fractures while simultaneous fractures at other sites healed without excessive callus. The author does not agree with Brailsford's suggestion that scurvy plays a part in this reaction. The excessive callus cannot be attributed to the excessive local hemorrhage and muscle damage, of which there is no evidence.

Apart from trauma it is difficult to assign any exciting cause for the excessive reaction. It is curious that, in spite of the poor osteoblastic function in osteogenesis imperfecta, the local reaction to the stimulus of a fracture is good. Until we know more about the general and local mechanisms controlling osteoblastic activity, it is impossible to explain either the good callus formation usually shown in these cases or occasional excessive reactions here reported.

Twenty-five roentgenograms; 6 photomicrographs.

HUGH A. O'NEILL, M.D.
Cleveland, Ohio

Bone Lesions in Eosinophilic Granuloma, Hand-Schüller-Christian Disease, and Letterer-Siwe Disease. Ignacio Ponseti. J. Bone & Joint Surg. **30A:** 811–833, October 1948.

Eight cases, well documented with the histories, roentgenograms, and photomicrographs, are reviewed in an attempt to show the relation between eosinophilic granuloma of bone, Hand-Schüller-Christian disease, and Letterer-Siwe disease. The mildest form of the fundamental condition is the eosinophilic granuloma, manifested clinically by tumor, tenderness, and slight pain. Films of the bone show a more or less clear-cut defect well outlined by normal appearing bone. There may be some periosteal new bone formation, and sometimes pathological fracture. Recurrence after surgical removal or roentgen therapy is unusual, though a malignant form resistant to treatment and with a tendency to recur has been observed. Multiple granulomas may be present. One case in this series had the appearance of a transitional stage between multiple eosinophilic granuloma and Hand-Schüller-Christian disease. Others showed a stage intermediate between Hand-Schüller-Christian disease and Letterer-Siwe disease.

The age of the patients varied, although the condition is usually first seen in childhood. Skin lesions are frequent, as is a peculiar type of gingivitis, which may be the original symptom of the disease. Small cystic changes adjacent to the alveoli, demonstrable roentgenographically, may accompany the gingivitis. The ear canals may be inflamed and show granulation tissue. The mastoid is often involved by the cystic process.

Exophthalmos may be seen. The lymph nodes are frequently enlarged, and sometimes the liver and spleen. Chest films often show extensive infiltration of the lung fields. Diabetes insipidus may be an early symptom, usually improving with improvement in the bone lesion. The red blood count may be low, but the leukocytes are often increased, especially the neutrophils, and a slight eosinophilia may or may not be present.

Any bone in the body may be affected. The skull is a frequent site, showing an area of destruction quite sharply outlined and surrounded by normal appearing bone. Healing of the lesions may occur by resolution, but eosinophilic granuloma may first pass through a lipogranulomatous stage.

The cause of these diseases is unknown. The lesion appears to be entirely different from those in the lipoid-storage diseases, such as Niemann-Pick disease, and it is therefore thought that Hand-Schüller-Christian disease and Letterer-Siwe disease should not be classed with disturbances of lipoid metabolism.

Roentgen therapy usually relieves the bone pain and is recommended in all cases of eosinophilic granuloma, Hand-Schüller-Christian disease, and Letterer-Siwe disease, although the effect upon the general course is difficult to evaluate.

Twenty-four roentgenograms; 11 photomicrographs.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Eosinophilic Granuloma, with Simultaneous Involvement of Skin and Bones. James H. McCreary. Arch. Dermat. & Syph. **58:** 372–380, October 1948.

A case of granuloma of the bone with cutaneous ulcerations is reported. The ulcers originated partly in the skin proper and developed partly over abscessed lymph nodes with draining sinuses. Histologically, eosinophils and histocytic macrophages were prominent. Unusual features of this case were: onset at the age of two, protracted course over eleven years, simultaneous presence of cutaneous and bony lesions in different regions, lymphadenopathy, and radiosensitivity of the lesions. These showed remarkably good response to bone curettage, local roentgen irradiation, and intravenous radioactive phosphorus (P^{32}) therapy.

The differential diagnosis of Hodgkin's disease, eosinophilic granuloma of the bone, eosinophilic granuloma of skin, Letterer-Siwe disease, and Hand-Schüller-Christian disease is discussed.

One roentgenogram; 4 photomicrographs; 2 photographs.

Massive Hyperplasia of Bone Following Fractures of Osteogenesis Imperfecta: Report of Two Cases. Walter E. Vandemark and Manley A. Page. J. Bone & Joint Surg. **30A:** 1015–1017, October 1948.

Two case reports are presented of osteogenesis imperfecta with fracture followed by local heat, redness, pain, tenderness, and some fever. The possibility of a malignant lesion was considered in both instances. The exact nature of the process in these two cases is not clear, but it would appear to indicate a quantitatively exaggerated repair reaction of the osteoblasts, whose qualitative defect characterizes osteogenesis imperfecta.

Five roentgenograms; 1 photomicrograph.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

A Case of Polyostotic Fibrous Dysplasia. A. C. Bingold. Brit. J. Surg. **36:** 22–26, July 1948.

A case of typical fibrous dysplasia in a patient seventy years of age is reported. The author believes that his patient is the oldest recorded in the literature, demonstrating that the disease does not shorten the expectation of life, but merely causes deformities and spontaneous fractures. The patient experienced both traumatic and pathological fractures during the course of his life, all of which united in average time. The involvement of the carpus and tarsus and a sclerosis of the cortex and medulla of the tibia were the unusual features in this case. The only endocrine changes were the delayed breaking of the voice, at twenty years of age.

Eight illustrations, including 6 roentgenograms.

HUGH A. O'NEILL, M.D.
Cleveland, Ohio

Gout Simulating Rheumatoid Arthritis. William A. Read and Russell Buxton. Virginia M. Monthly **75:** 493–497, October 1948.

An unusual case of gout in a 36-year-old white male, mimicking rheumatoid arthritis, is presented. The history extended over twelve years, commencing with isolated attacks of acutely painful inflammatory involvement of one great toe, subsiding in two weeks. Later other joints, in all four extremities, became involved, the attacks gradually becoming more frequent, with less return to normal, until finally three years prior to hospital admission, the patient was totally disabled.

On admission to the hospital, marked restriction of movement of the involved joints was noted, along with thickening and enlargement of the articular regions and muscular and cutaneous atrophy. Tophi were detectable in the helix of either ear and over one olecranon. The blood chemistry findings were consistent with gout. Roentgenograms revealed extensive changes, varying in degree from one joint to the other, consisting of osteoporosis, joint cartilage destruction with narrowing, punched-out lesions subchondrally, and subluxation. The interphalangeal joints of the hand were largely spared.

Treatment by a low-purine, low-fat diet, colchicine, orthopedic and physiotherapeutic measures brought about considerable improvement.

The history of severe attacks with complete remission in the earlier stages, the favorable response of an acute attack to colchicine, and the sparing of the proximal interphalangeal joints are pointed out as particularly favoring the diagnosis of gout over rheumatoid arthritis.

Four roentgenograms; 3 photographs; 1 photomicrograph.

J. E. WHITELEATHER, M.D.
Memphis, Tenn.

Importance of Leprosy in Orthopedic Surgery. John W. Metcalfe. U. S. Nav. M. Bull. **48:** 656–667, September–October 1948.

The probability of an increased number of sporadic cases of leprosy in the temperate zones following the mass migration of troops and their families through endemic areas is pointed out and a general discussion of the disease is presented, with special attention to its orthopedic aspects.

The roentgen signs are tabulated as follows:

Small peripheral lesions of fingers and toes
1. "Notching" of tip
2. "Sliced-off" appearance
3. "Fraying" of tuft
4. "Collar-button absorption" of short phalanges
5. Enlarged nutrient foramen

Joint lesions
1. Subchondral cysts
2. Degenerative and proliferative changes
3. Ankylosis
4. Subluxation
5. Complete disorganization

Larger lesions
1. Transverse linear zone of rarefaction at phalangeal epiphysis—a leprous osteochondritis
2. Cystic degeneration near nutrient artery of phalanx—a leprous osteomyelitis
3. "Concentric bone atrophy" with narrowing of shaft without rarefaction. Thinning obliteration of marrow cavity with dense cortices
4. "Pointing"—absorption of distal articulating surface of bone with "awl-shaped" appearance, also likened to that of a "sucked candy stick."
5. Disappearance of digit or ray

Eight roentgenograms; 6 photographs; 3 tables.

Brucellosis as a Cause of Sacroiliac Arthritis. A Study of Its Relationship to Rheumatoid Spondylitis. Charles LeRoy Steinberg. J. A. M. A. **138:** 15–19, Sept. 4, 1948.

A case of brucellosis is reported in which there were pain and limitation of motion in the left sacroiliac joint. Roentgenograms showed loss of definition of the articular margins of this joint, together with an area of bone destruction measuring approximately 1 cm. in diameter near the upper border of the joint. There was also widening of the lower aspect of the left sacroiliac joint.

In the differential diagnosis consideration was given also to neoplasm and rheumatoid spondylitis. The final diagnosis of arthritis due to *Br. abortus* was arrived at by careful correlation of the history, laboratory, roentgen, and clinical findings.

Films made approximately one month later again showed the area of bone destruction, but in addition there was a suggestion of ankylosis in the mid portion of the joint.

Six roentgenograms; 1 chart.

E. E. BREYFOGLE, M.D.
University of Michigan

Solitary Plasmocytoma of Bone with Renal Changes. George Lumb. Brit. J. Surg. **36:** 16–22, July 1948.

This paper reports a single case of solitary plasmocytoma of bone in the sacroiliac region, with renal changes. This is the sixteenth proved case of solitary plasma-cell tumor of bone to be recorded in the literature. The patient, a man aged 52, was followed for a period of thirteen months, during which time a complete x-ray survey of the skeleton was made.

The principal interest in the case lies in the extensive and thorough postmortem examination. Most of the skeleton was carefully studied both grossly and microscopically. An interesting postmortem finding was the association of renal tubular blockage of the type found in multiple myelomatosis, with a solitary bone tumor. Bence-Jones protein had been found in the urine, despite the fact that only one tumor could be demonstrated after careful autopsy. The author suggests that the appearance of Bence-Jones proteinuria may be a result of actual tumor volume or the amount of bone-marrow involved. He further suggests that this was not a tumor which had not yet metastasized, nor a separate disease entity, but simply a single focus of a disease usually presenting in multifocal form.

One roentgenogram; 6 photomicrographs; 4 photographs.

HUGH A. O'NEILL, M.D.
Cleveland, Ohio

Myelographic Studies with Pantopaque. Francis P. Carrigan. J. M. Soc. New Jersey **45:** 484–485, October 1948.

Pantopaque, introduced in 1941, has proved to be the best contrast medium for radiographic studies of the subarachnoid space. It is easily introduced and withdrawn; it tends to remain in a homogeneous mass, is relatively non-toxic, and is absorbed at the rate of about 1.0 c.c. per year. This is a very general paper, outlining the technic of introducing the contrast medium and the method of examination. The necessity of thorough accommodation of the fluoroscopist's eyes is emphasized.

Defects in the pantopaque column are described and related to the underlying pathologic change. Errors in interpretation may be due to adhesions resulting from a previous arachnoiditis, varices, previous surgery, osteophytes protruding from the margins of the vertebral bodies, etc.

ALTON S. HANSEN, M.D.
Peoria, Ill.

Diagnosis and Treatment of Protruded Lumbar Intervertebral Disks. Claude D. Wilson. Texas State J. Med. **44:** 445–449, October 1948.

The author stresses the relative ease with which most diagnoses of herniated intervertebral disks are made but points out that treatment of these lesions is not yet mastered. The role of the radiologist in definitely proving the presence of a protrusion is extremely important.

The routine radiographic examination of the lumbar spine will reveal changes which suggest a diagnosis of ruptured disk or tend to exclude it. Most patients with a long history of disk symptoms show some bony proliferation and a narrowing of the cartilage space. Developmental anomalies, while not clinically important, should be demonstrated, and such diseases as arthritis, tuberculosis, and primary and metastatic carcinoma, should be excluded as causes of pain.

The advantages of pantopaque myelography are discussed. The author prefers to use 5 or 6 c.c. Lateral defects are the most common, and are usually accompanied by distortion or obliteration of the nerve root sheath at the involved level. The size of the defect in the oil column is not always proportionate to the size of the protruded mass.

A lateral protrusion may compress the nerve root sheath without producing a defect in the oil in the subarachnoid space. In such instances, the nerve sheath filling may be absent, elevated, depressed or distorted. This is a reliable finding, and when present indicates nerve root pressure.

The various types of defects and the mechanism of their production are described. Surgical treatment should be reserved for those patients with severe intractable pain who do not respond to conservative measures, and in whom a definite diagnosis of protrusion of a disk can be established.

Four roentgenograms; 1 photograph.

ALTON S. HANSEN, M.D.
Peoria, Ill.

Bilateral Fracture of the Pars Interarticularis of a Lumbar Neural Arch. Maurice B. Roche. J. Bone & Joint Surg. **30A:** 1005–1008, October 1948.

A case of so-called "traumatic spondyloschisis" is reported. A 22-year-old man was admitted to the hospital with multiple injuries as the result of an automobile accident. The most interesting of these was a bilateral fracture of the isthmus between the articular facets of the third lumbar vertebra, demonstrable in anteroposterior, lateral, and oblique views. Follow-up examination showed definite healing of the fractures.

Nine roentgenograms. JOHN B. MCANENY, M.D.
Johnstown, Penna.

Fracture-Subluxations of the Shoulder. T. J. Fairbank. J. Bone & Joint Surg. **30B:** 454–460, August 1948.

Fractures of the upper end of the humerus are not uncommonly associated with downward subluxation of the head of the humerus from the glenoid, a fact which appears to have passed almost unnoticed. In a search of the literature, mention of this type of downward subluxation was found only twice.

In a series of 115 fractures of the upper end of the humerus, treated at the Manchester Royal Infirmary, there were 12 (10 per cent) in which downward subluxation of the shoulder joint was seen at one time or another. In 6 it was present at the first attendance; in 6 it appeared several days or weeks later.

There appear to be three possible explanations for these subluxations. First, subluxation may result directly from the violence of the injury. Secondly, it is possible that there may be weakness of some muscle which normally retains the humeral head in the glenoid. Thirdly, as Cotton (1921) first suggested, the subluxation may be due to loss of tone in the longitudinal muscles from the scapula, namely, the biceps and coracobrachialis, the long head of the triceps, and particularly the deltoid. This suggestion receives support from the clinical finding that the subluxation is reduced when gravity is eliminated or when the muscles are braced.

To investigate the degree of dislocation which is possible in the normal shoulder, conscious subjects were laid on the x-ray table and strong traction was applied with the limb by the side; countertraction was maintained by means of a soft towel around the axilla. Some downward movement of the humeral head was constant but usually it was very slight. Using the same method of traction under anesthesia, quite severe subluxation could be produced regularly without great force. Negative pressure is created in the shoulder sufficient to draw the rotator cuff towards the joint cavity.

A number of dissections and radiographic examinations were performed in the postmortem room to determine which structures prevented the head of the humerus from sliding out of the glenoid fossa when the limb was pulled downwards. The results are summarized thus: (1) All structures running down the arm from the shoulder, including vessels and nerves, play some part in maintaining congruity of the joint. (2) If the whole rotator cuff is divided, the force necessary to subluxate the joint is slightly but only slightly diminished. (3) If all the structures except the supraspinatus are divided, the force necessary to produce subluxation is very small. (4) The glenoid labrum appears to be too thin and pliable to have much stabilizing effect.

Attempts were made to determine what part an effusion into the joint might play. Air or water injected into the joint cavity did not alter the stability of the joint significantly, but it was found impossible to maintain any great tension, owing to the leakage under the subscapularis and down the long head of the biceps.

It is thus concluded that the most important factor in retaining congruity of the shoulder joint is the tone of the muscles running longitudinally, although the spinati may have played a minor part.

It is suggested that the use of a collar and cuff sling as a method of treatment for fractures of the shoulder is not without danger. A triangular sling usually prevents or cures the displacement.

Twelve roentgenograms. HUGH A. O'NEILL, M.D.
Cleveland, Ohio

An Unusual Anomaly of the Inferior Portion of the Scapula. F. Y. Khoo and C. L. Kuo. J. Bone & Joint Surg. **30A:** 1010–1011, October 1948.

The scapular anomaly described here was an incidental finding in the roentgen examination of a Chinese male of forty-two years. The right scapula was shorter than usual due to the absence of its inferior fourth. The inferior aspect instead of being pointed was represented by two processes, one on either side, with a semi-elliptical notch between them. The notch measured about 2.5 cm. wide and 1.5 cm. deep.

Hrdlička (Am. J. Phys. Anthropol. **29:** 73, 1942) is quoted on the variations in form that may be presented by the scapula. A frequent variation is the presence of a fourth border inferiorly rather than a point. This fourth border may show numerous contours with points and depressions. In the case reported here, however, the changes were so pronounced that the authors feel justified in regarding it as a developmental anomaly rather than a simple variant.

One roentgenogram. JOHN B. MCANENY, M.D.
Johnstown, Penna.

Congenital Bilateral Complete Absence of the Radius in Identical Twins. Raphael B. Goldenberg. J. Bone & Joint Surg. **30A:** 1001–1003, October 1948.

Each of a pair of identical twins showed bilateral club hands and bilateral absence of the radius and thumb. One child had four fingers on the right hand and two on the left, while the other had four fingers on each hand. In one, flexion of the left elbow was limited to 90 degrees. An operative attempt to correct the clubbing, at the age of nine years, was successful only on the left hands.

This is believed to be the first report of congenital bilateral absence of the radius in twins.

Twelve roentgenograms; 2 photographs.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Pneumoarthrography of Traumatic Lesions of the Meniscus. Telmo Corrêa and José Botelheiro. Gaz. méd. Portuguesa **1:** 515–522, 1948. (In Portuguese)

The authors consider pneumoarthrography a supplement to careful history and examination in the great majority of traumatic lesions of the meniscus. They describe their own technic for this procedure. This involves fluoroscopy to obtain a clear image, which is then fixed by radiography.

Nine roentgenograms.

Traumatic Instability of the Ankle Joint. Otto C. Kestler. Am. J. Roentgenol. **60:** 498–504, October 1948.

Ligamentous injury of the ankle joint calls for a special roentgen technic: (*a*) routine anteroposterior, lateral, and oblique exposures; (*b*) an anteroposterior view with the forefoot held in extreme inversion, a motion usually restricted by severe pain; (*c*) a similar view after the injection of 5 to 10 c.c. of 2 per cent procain hydrochloride solution to permit maximal painless inversion. The point is made that the foot should be kept at 90 degrees in relation to the leg while inversion is carried out, since some tilting will take place if the foot is in plantar flexion.

Proper treatment of the acute case will result in a stable ankle, and, since this involves a cast for eight to twelve weeks' time, it is important to be able to diagnose the extent of the injury. Chronic cases are repaired surgically with good results.

Twelve roentgenograms; 1 drawing; 2 photographs.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

The Accessory Tarsal Scaphoid. Isadore Zadek and Aaron M. Gold. J. Bone & Joint Surg. **30A:** 957–968, October 1948.

An investigation was made into the ultimate fate of the accessory tarsal scaphoid by re-examination of 8 patients with 14 accessory scaphoids at intervals of one to eight years after the original roentgen study. Five of the accessory bones became united with the main scaphoid, while 3 showed partial union; in 5 cases fusion failed to occur.

Numerous accessory scaphoids are removed because of pain and disability, and in the process a portion of the medial end of the scaphoid is also removed. Microscopic study of such specimens showed that the accessory scaphoid and the true scaphoid were joined by a layer of soft tissue, consisting of hyaline cartilage, dense fibrocartilage, or both. This soft-tissue plate frequently showed active ossification on either side, indicating that it was well on its way to obliteration. The persistence of the accessory bone into adult life in some cases is attributed to a discontinuance of this ossification process at or about the time that growth ceases and the epiphyses of the skeleton close.

In none of the authors' cases was a true joint found. In some instances the appearance suggested trauma with a hemorrhagic reaction. One specimen showed what appeared to be a joint space, but the bones were capped by fibrocartilage instead of hyaline cartilage. In most cases showing an accessory scaphoid, the tibialis posterior tendon is attached to the scaphoid tubercle to a greater degree than normally.

Nine roentgenograms; 10 photomicrographs; 1 photograph.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Diffuse Inflammation of Cartilage. A Case Report of a Hitherto Unreported Entity. Everett J. Gordon, Aaron W. Perlman, and Nathan Shecter. J. Bone & Joint Surg. **30A:** 944–956, October 1948.

This is an extensive report of the case of a Negress, thirty-four years of age, with an inflammatory process involving various types of cartilage in various parts of the body, including the auricles of both ears, the larynx, the ankles, the left knee, and the costal cartilages. The disease ran an inflammatory course and penicillin produced some relief. The Kahn test was weakly positive, as was also the complement-fixation test for gonorrhea, but it is believed that these reactions may have been non-specific in nature.

Ossification of both auricles was observed roentgenographically and microscopically. Roentgenograms of the left knee showed narrowing of the joint space, resorption of joint cartilage, and demineralization of the bones. A similar picture was presented by the ankles.

No other case has been found in a review of the literature, domestic or foreign, and study of microscopic sections has failed to establish a definite diagnosis. The condition has been designated "diffuse inflammation of cartilage," merely for identification purposes.

Seven roentgenograms; 8 photomicrographs; 4 photographs.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

BLOOD VESSELS

Some Technical Considerations in the Arteriographic Examination of the Lower Extremity. R. Glenn Smith and Darrell A. Campbell. Surgery **24:** 655–661, October 1948.

Another arrangement is described for making arteriograms of the lower extremity. An anteroposterior projection at a distance of 6 feet is made; a cassette changer accepts two 14 × 17-inch cassettes lengthwise and is so masked as to allow two side-by-side exposures on one 14 × 17-inch film merely by sliding the cassette tray during the period before the second exposure. After local anesthesia, an 18-gauge short-bevel needle is introduced percutaneously into the femoral artery just below the inguinal ligament. The artery is compressed digitally proximal to the needle, 25 c.c. of diodrast are injected as rapidly as possible, and the first exposure is made. The films are shifted and pressure is released for four seconds while the remaining 5 c.c. of diodrast are injected, and the second exposure is made. The average technical factors used are: 68 kv., 300 ma., 1/20 sec.

At least two serial films during injection are necessary to visualize obstructions at some distance from the closest communication; time is allowed for diffusion of diodrast into the stagnant blood near the point of occlusion. Also, the time interval allows filling of the major trunk beyond the obstruction, in cases with intermittent occlusion, through permeation of collaterals. Retrograde filling may occur in some instances.

A warning is included against possible overexposure to the individual injecting the diodrast.

Interpretation of the arteriograms is not discussed, being reserved for another paper.

Detailed drawings of the cassette changer; diagram of the projection; one set of roentgenograms.

J. E. WHITELEATHER, M.D.
Memphis, Tenn.

Aneurysm of the Renal Artery: Report of Five Cases, One Treated by Resection of Aneurysmal Sac Without Sacrificing the Kidney. Charles Pierre Mathé. J. Urol. **60:** 543–551, October 1948.

The author presents five cases of aneurysm of the renal artery which were discovered incidental to renal surgery for other causes. The point is clearly made that diagnosis is very difficult preoperatively except by angiography. The classic wreath-like calcification is frequently not demonstrable, though some calcification is relatively common.

The series is presented primarily to encourage the genito-urinary surgeon to think of this condition and to describe two cases in which aneurysms were treated successfully without nephrectomy. In one of these cases the aneurysm involved only one of the branches of the renal artery and this branch was resected without sacrificing the kidney. In the second instance, a small aneurysm associated with a ptotic kidney, symptoms were relieved by sympathectomy and suspension. Apparently the aneurysmal wall was reinforced by the postoperative fibrosis.

Two roentgenograms; 3 drawings.

N. F. ZIMMERMAN, M. D.
University of Pennsylvania

Radiological Diagnosis of the Cruveilhier-Baumgarten Syndrome. A. Celis, J. F. Espinosa, and J. A. Fregoso. Gastroenterology **11:** 253–255, August 1948.

The Cruveilhier-Baumgarten syndrome is a rare clinical entity characterized by unusually prominent periumbilical veins, evidence of portal hypertension, atrophy of the liver, splenomegaly, and a venous hum at the site of the periumbilical circulation.

A case is reported, in a man of 36, exhibiting all but the last of these features. Twenty cubic centimeters of an 80 per cent solution of Nosylan were injected into the vein, and a roentgenogram was immediately made. An excellent demonstration of the patent umbilical vein and its connection with the portal vein and of the intrahepatic portal system was obtained following an additional injection of 25 c.c. of the opaque material. The procedure produced only a moderate chill.

The syndrome is briefly discussed, and it is concluded that this method of roentgen examination permits the diagnosis of the syndrome.

One roentgenogram. ALTON S. HANSEN, M.D.
Peoria, Ill.

OBSTETRICS AND GYNECOLOGY

Advantages of Hysterosalpingography Under Fluoroscopic Control. Daniel W. Goldman. Urol. & Cutan. Rev. **52:** 606–607, October 1948.

The author feels that there is a definite advantage in being able to watch the flow of the opaque medium through the uterus and fallopian tubes when doing hysterosalpingography. He describes his simplified fluoroscopic technic. Among the points which he makes are the desirability of the routine use of antispasmodics and of administration of one of the histamine antagonists just prior to the test and the advantages of a quickly absorbed aqueous contrast medium over lipiodol.

A scout film is taken before the injection is begun, for the identification of calcified lymph nodes, phleboliths, or calculi, and to check the position of the cannula. The opaque medium is injected in fractions of 1.5 to 2.0 c.c. initially, a total of 5 to 8 c.c. being used. Spot films are taken as indicated.

Fluoroscopic study allows placing the patient in both oblique positions for observation and eliminates confusion in interpretation when the uterine shadow lies over the tubal shadows, as in routine anteroposterior views.

MAURICE D. SACHS, M.D.
Cleveland, Ohio.

THE GENITO-URINARY SYSTEM

Urologic Investigation of Abdominal Masses. William J. Engel. S. Clin. North America **28:** 1193–1208, October 1948.

The presence of an abdominal mass is a frequent diagnostic challenge which even the most astute clinician is rarely able to meet without aid of special studies. Since the majority of such masses occur in the flank of the abdomen, urologic examination is of great value in determining their location and nature.

After complete urinalysis, a plain film of the abdomen is made with a technic designed to bring out soft-tissue masses to best advantage. Following this, an intravenous pyelography is done, films being obtained at intervals of five, fifteen, thirty, and sixty minutes after injection of diodrast. If this does not yield the desired information, one must proceed with cystoscopy, ureteral catheterization, and retrograde pyelography. Added studies in selected cases include oblique pyelograms and respiration pyelograms. For the latter a double exposure is made on one film, the first in deep inspiration and the second in expiration, the exposure for each being about 75 per cent of that for the usual single exposure.

The author groups abdominal masses into three broad categories: (1) those which are intraperitoneal; (2) those which are retroperitoneal, but extrarenal; (3) masses of renal origin. Illustrative cases of each group are given, with photographs of the operative specimens and good detail roentgenographic reproductions (which are better seen than described).

It is pointed out in conclusion that one must disparage a tendency to consider "abdominal mass" as an adequate diagnosis for which to recommend surgical intervention. The diagnosis must be drawn much finer in order to justify operation or to plan the surgical approach.

Several clinical aphorisms are stated as emerging from the author's study.

(1) A normal urogram immediately excludes a retroperitoneal mass. [This is too broad a statement and not always true, especially in the case of retrogastric or pancreatic masses.—S.F.T.]

(2) Ureteral displacement indicates a retroperitoneal mass.

(3) Renal displacement denotes a retroperitoneal tumor.

(4) Distortion of the renal pelvis may be produced by extrarenal masses.

(5) True deformity of the renal pelvis always indicates an intrinsic kidney lesion. [It may not be possible to differentiate a true from an extrinsic deformity of the renal pelvis; the "always" of this aphorism is, therefore, not justified.—S.F.T.]

Sixteen illustrations, including 11 roentgenograms.

S. F. THOMAS, M.D.
Palo Alto, Calif.

The Bladder in Genital Prolapse. Armando Trabucco. J. A. M. A. **137:** 1578–1581, Aug. 28, 1948.

The urologic symptoms associated with genital prolapse are: (1) dysuria, pollakiuria, and incontinence during muscular effort; (2) incontinence with total voiding of the bladder; and (3) incontinence, paradoxically accompanied by more or less pronounced retention of urine. These three symptoms characterize the three degrees of prolapse.

Close observation of the cystogram reveals that the greater the prolapse, the more the bladder is displaced backward, thus changing the normal anatomy of the organ, particularly of the vesical neck. The posterior lip, instead of forming a right or slightly acute angle placed above the anterior lip, during prolapse forms an obtuse angle, half open and pulled down and backward. This deformation affects the urethra and forces it to change from the vertical to a backward, downward oblique direction.

Three roentgenograms; 1 drawing.

Diagnosis of Bladder Stones. William Boss. Schweiz. med. Wchnschr. **78:** 959–960, Oct. 2, 1948. (In German)

The case of a 76-year-old man with prostatism and rather severe pain and dysuria is presented. The plain film failed to demonstrate an abnormality, but double-contrast cystograms (made with 10 per cent sodium bromide solution, followed by air after evacuation) showed a diverticulum about the size of the gallbladder, containing a lamellated stone. The author warns against being content with a plain film and cystoscopy, especially in cases in which other abnormalities make the latter procedure difficult. Cystography should be done, and the double contrast method is especially good for the demonstration of diverticula.

Three roentgenograms. LEWIS G. JACOBS, M.D.
Oakland, Calif.

Urethrocystography in the Male Child. M. Leopold Brodny and Samuel A. Robins. J. A. M. A. **137:** 1511–1517, Aug. 21, 1948.

In a report based on over 250 male patients under the age of sixteen years a simple method of urethrocystography is described. The cystogram is obtained by injecting 20 per cent rayopake and subsequent filming. Following this procedure a urethrogram is obtained by filling the bladder with rayopake until the patient has a desire to void. He then voids into a non-opaque container, the x-ray exposure being made when the stream has assumed full force. In some cases urethrography is done after pyelography, the collected dye in the bladder being voided and films taken as in the procedure above. In addition, retrograde filling of the urethra is done, using 10 to 15 c.c. of rayopake and a special clamp with a cannula with a metal tip which obturates the urethral meatus. A film is exposed during injection.

The major conditions for which this examination is of value are: congenital anomalies, obstruction uropathies, infections, neuromuscular dysfunctions, control of surgical status.

It is emphasized that interpretation of urethrograms requires considerable practice and correlation with cystographic findings, but with concentrated effort diagnostic accuracy compares with that of pyelography.

E. E. BREYFOGLE, M.D.
University of Michigan

MISCELLANEOUS

Symptoms Masked or Modified by Chemotherapy. The Increasing Responsibility of the Roentgenologist. Vincent W. Archer, George Cooper, Jr., and Norman Adair. J. A. M. A. **138:** 645–650, Oct. 30, 1948.

A series of individual case reports is presented to illustrate the fact that chemotherapy sometimes controls symptoms while the disease process progresses or remains stationary. In either event the proper surgical intervention is delayed because things seem to be going well. The point is made that in interpreting films on cases undergoing chemotherapy one must not be swayed by the response of symptoms—if the findings indicate that there is loculated pus, for example, it should be reported as such with the realization that chemotherapy may not have completely eradicated the infection.

The conditions represented in the case reports, in which symptoms were strikingly changed by chemotherapy, were: (1) diverticulitis with cancer of the sigmoid; (2) fibrosarcoma of the femur; (3) perinephritic abscess; (4) lung abscess; (5) acute cholecystitis; (6) mastoiditis; (7) subphrenic and subhepatic abscess; (8) empyema; (9) osteomyelitis.

Nine roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

RADIOTHERAPY

Irradiation in Cancer of the Tongue. Charlotte P. Donlan. Am. J. Roentgenol. **60:** 511–521, October 1948.

Cancer of the anterior two-thirds of the tongue is usually well differentiated and metastasizes by way of the regional lymph nodes. Lesions of the base, on the other hand, are usually more malignant and often metastasize to distant areas.

Radium implantation with low intensity needles is used in the anterior two-thirds in most cases. Sometimes roentgen therapy is first given to shrink the lesion or reduce infection. The needles remain in place five to seven days to give a calculated tumor dose of 8,000 gamma roentgens. The usual precautions in regard to the teeth, gums, fluid balance, mouth irrigations, etc., are taken. If roentgen therapy is substituted for radium implantation, an attempt is made to deliver a tumor dose of 5,000 r, using an intraoral cone 3 or 4 cm. in diameter. Lesions at the base of the tongue are usually treated with external irradiation through two or three fields for a total dose to the tumor of 5,000 to 6,000 r.

Prophylactic neck dissection is done on the affected side provided the lesion is controllable and does not cross the midline. Bilateral dissection is done if the lesion crosses the midline or if nodes are palpable on the opposite side.

Results in 83 unselected cases are presented, showing the tumor doses administered. The five-year survival rate was 30.9 per cent for the whole group.

Seven illustrations, including 1 roentgenogram.

ZAC F. ENDRESS, M.D.
Pontiac Mich.

Carcinoma of the Nasopharynx. C. Calvin Fox. Arch. Otolaryng. **48:** 390–401, October 1948.

Twelve cases of transitional-, squamous- or anaplastic-cell carcinoma of the nasopharynx, all atypical forms, constitute the basis of this report.

The four most important early symptoms of carcinoma of the nasopharynx are cervical adenitis, earache or deafness, hemoptysis, and nasal obstruction. Other early symptoms are pain in the frontal area and the face along the distribution of the trigeminal nerve, hoarseness, and some disturbance in swallowing. In 6 cases in the present series paralysis of one or more cranial nerves developed. Five patients had disturbance of the fifth nerve, expressed in varied degrees of facial pain. In 9 cases the cancer was first seen on the superolateral wall of the nasopharynx, in 2 in the fossa of Rosenmüller, and in 1 on the posterior wall.

Metastasis usually occurs fairly early. In this series the lymph nodes were involved in 10 cases and the ribs in 3.

Roentgen studies are of diagnostic value when the tumor has become large enough to project into the cavity of the nasopharynx. Lateral or mentovertex views should be taken at various angles because of the variation in the bones and the location of the tumor. Alteration, erosion, or obliteration of the foramens, especially the foramen lacerum medium, the foramen ovale, the orbital fissures, and the jugular foramen, are most often found. In 2 cases of this series it was possible to see the tumor projecting into the nasopharyngeal space. Three patients had erosion of the sphenoid bone, 1 had erosion of the foramen lacerum medium, and 1 had rather extensive destruction of the petrous portion of the temporal bone. This patient also had tumor tissue in the middle ear. It could not be determined whether it reached the ear by way of the eustachian tube or whether it extended from the involved petrosa. In this series roentgen examination gave evidence of the tumor in half the cases, but not until the growth was well beyond the primary stage.

Irradiation is the treatment of choice, since nasopharyngeal carcinomas are highly sensitive to both roentgen rays and radium and are very inaccessible to other measures. In all 12 cases reported here, the tumor was irradiated with roentgen rays. Only 1 patient, treated in 1938, had radium used initially. The initial dose of roentgen radiation should be of maximum amount. A dose of 3,500 r (in air) directed through each part of the tumor is considered necessary. Treatment is started with a 10 × 15-cm. field extending from the level of the brow to the level of the cricoid cartilage, with additional coverage to fit the individual case when indicated. With the larger fields, the treatment may be given to the opposite side on alternate days. When excessive mucous secretion or drying occurs, either the dose or the size of the field is reduced. At other times the field may be split into two parts and each treated with a smaller dose. The larger fields are treated with up to 250 r per day for a total of 2,500 to 3,000 r (in air). If two smaller fields are used, the daily dose is 125 to 150 r each. Next the treatment is applied to a port over each antral area until a total of 2,000 to 2,500 r (in air) has been reached by a daily dose of 225 to 250 r. After this a port through the frontal area above the brow is used and the radiation directed downward through the petrosa if the lesion is in the petrous apex or the orbit. Finally a port through the occiput is used to reach the same dose.

Six patients in the series are living and 6 are dead. Among those who died the interval between the primary symptom and death ranged from six to more than twenty-seven months, with only 1 patient living more than twenty-seven months. Of the patients still living, 2 have survived ten years. The other 4 have lived from fourteen to twenty-nine months, and their future is, of course, still uncertain.

Nine illustrations, including 4 roentgenograms.

Carcinoma of the Breast and Its Treatment. Cecil Wakeley. Brit. M. J. **2:** 631–635, Oct. 2, 1948.

The pathology of breast carcinoma is discussed briefly, with emphasis on routes of spread and the assertion that supraclavicular node involvement means intrathoracic extension and indicates inoperability. Symptoms and physical diagnostic signs are described and we are reminded that "there is only one early sign of carcinoma of the breast and that is the presence of a lump." With regard to histologic diagnosis, the author cautions against the *partial* excision of suspicious lumps.

In Stage I carcinoma radical mastectomy is advised, with the exception that inner quadrant tumors in slight women should be locally removed and follow-up radiotherapy employed. Evaluation of results in the author's own series does not justify irradiation following radical mastectomy in Stage I cases. His five- and ten-year survival rates in this group are 81 per cent and 65 per cent, respectively.

Stage II carcinoma is treated with preoperative irradiation and radical removal two months later. X-ray therapy often reduces the size of the primary lesion as well as the axillary tumor and lessens the risk of dissemination. The five-year survival for this group was 25 per cent.

In Stage III surgery is "of little avail," being principally "an ancillary to the x-ray therapy."

For palliation in Stage IV, the author states that testosterone "gives results comparable to those obtained by stilbesterol in cases of carcinoma of the prostate."

Radium, as opposed to x-rays, is objected to on the basis of the lumpy appearance of the residual lesion and the limited range with respect to outlying lymphatic vessels.

The author describes his operative technic in detail, urges preservation of the clavicular head of the pectoralis major, and opposes dissection of the axillary artery and the brachial plexus. His treatment of carcinoma in males is local excision plus postoperative irradiation.

Four drawings.

JAMES ALLAN READ, M.D.
The Henry Ford Hospital

Early Diagnosis and Treatment of Carcinoma of the Breast. Victor Riddell. Brit. M. J. **2:** 635–639, Oct. 2, 1948.

Riddell emphasizes the "fallibility of the clinical diagnosis" of breast carcinoma and condemns the "fatal period of observation." "Urgency for investigation is greatest in those patients in whom the cardinal signs are absent and the diagnosis is uncertain, because it is with these patients that the chances of cure are the highest."

The clinical examination is described, including search for metastases by x-ray survey of chest, spine, and pelvis. In 50 per cent of patients without palpable axillary nodes invasion has occurred, whereas the clinical error with palpable nodes is 21 per cent.

Choice of treatment is determined by joint evaluation by surgeon and radiotherapist. The author recommends postoperative irradiation but discusses the theoretic advantages of preoperative irradiation: (1) no delay (such as that engendered by postoperative complications); (2) possible devitalization of cells which may subsequently be dispersed; (3) probable greater radiation tolerance of the skin when the blood supply has not been impaired by operative trauma. Disadvantages include the necessity for biopsy but the author has observed no tendency to render surgery more difficult. He feels that irradiation can never render the surgically incurable disease curable.

Preoperative irradiation is indicated where a relatively large skin defect is expected operatively because such defects are vulnerable to x-rays, healing is protracted, and irradiation must sometimes be "delayed until it may be useless."

Stage I and II cases require combined radical surgery and irradiation. Alternative therapeutic approaches have yet to prove themselves. Late Stage II cases require simple mastectomy and irradiation if two or more adverse factors are present, such as "rapid growth, wide involvement of skin by infiltration or ulceration, age over 65, and possibly a peripherally situated tumor, more particularly if it is in the inner hemisphere."

In Stage III (supraclavicular nodes, fixed axillary nodes, deep fixation of tumor, secondary nodules in skin, edema of the arm) irradiation is the indicated therapy; occasionally also simple mastectomy. In general, in this stage surgery "can only hasten the patient's end."

X-rays and hormonal therapy are employed in Stage IV.

The author remarks the inevitable limitation to individual experience in treatment of breast carcinoma and sees the need for evaluation of combined treatment technics by collaboration of individual surgeons and by surgeons associated with radiotherapy centers.

Four photographs. JAMES ALLAN READ, M.D.
The Henry Ford Hospital

Lymphatic Spread of Carcinoma of the Breast. Clarence W. Monroe. Arch. Surg. **57:** 479–486, October 1948.

The surgical specimens removed from 87 patients with carcinoma of the breast were washed free of blood, fixed, and cleared. The location of each lymph node was then diagrammed, and the node was removed for microscopic study. All of the specimens came from patients in whom the surgeon believed a radical cure might be effected. In 31 no lymph node metastasis was found. Of the others, 16 showed involvement of only a single node, while the number involved in the remaining patients varied from 3 to 70, with an average of 30.4. Study of the survival rates showed that the probability of cure increased as the number of lymph nodes removed increased. This would seem to favor more radical removal of the growth, with wider dissection.

Four drawings; 2 charts; 2 tables.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Treatment of Carcinoma of the Cervix. Robert A. Kimbrough and Craig W. Muckle. Am. J. Obst. & Gynec. **56:** 687–692, October 1948.

In most clinics at present the use of high-voltage x-ray therapy precedes the local application of radium in treatment of carcinoma of the cervix. The advantages of this procedure are devitalization of cancer cells before local manipulation can cause dissemination, partial or complete sealing of lymph channels, clearing up of the usual local infection, and restoration of cancer-distorted anatomic relationships. The authors use 2,000 to 2,800 r (air dose) to one 15 × 15-cm. port anteriorly and posteriorly, with filtration through 0.5 mm. copper and 1 mm. aluminum. If well tolerated, 200 r are administered anteriorly and posteriorly three times a week.

Six weeks after completion of the x-ray cycle, local application of radium is made. The authors use 6,000 mg. hr. to the cervical area, including the uterine cavity and the base of the broad ligaments, by means of 10-mg. capsules of radium with filtration of 1 or 2 mm. platinum. Interstitial radium is not used because of dangers of infection and injury to the ureters and the uterine vessels.

A review of results obtained in a series of cases treated from 1933 through 1941 is presented. A total of 130 patients was seen. Only 8 of these were considered too far advanced for treatment. Two-thirds of the patients had involvement beyond the uterus. The absolute five-year salvage rate was 27.6 per cent, or 36 patients of the total of 130. Approximately one-third of the 111 patients given a full curative treatment survived five or more years.

Conservative use of radical surgery in certain selected early cases is not believed to offer any better results than radiation therapy in cases of similar extent.

Ten tables. H. J. THOMPSON, JR., M.D.
Jefferson Medical College

Retreatment of Carcinoma of the Cervix. L. A. Calkins. South. M. J. **41:** 902–906, October 1948.

The author treated 500 patients with proved carcinoma of the cervix with radiation. Of these, 233 needed additional treatment (from four months to two years after the initial treatment). Fifty of the secondary treatments were given without hope of permanent cure, and probably without producing a single cure. In 110 patients the secondary treatment, given as a supplement to the first treatment, probably saved 14 lives. In 73 patients, a definite recurrence was treated, with 7 patients surviving the recurrence, 6 for five years or more. A total of twenty lives would thus seem to have been saved as a result of the secondary treatment of 233 patients.

Six tables. JOHN DECARLO, JR., M.D.
Jefferson Medical College

Radical Panhysterectomy (Wertheim) and Radical Pelvic Lymphadenectomy. A Preliminary Report of Seventy-Five Operations. Walter L. Thomas, Bayard Carter, and Roy T. Parker. South. M. J. **41:** 895–902, October 1948.

Because of the frequency of recurrence of cervical carcinoma and metastatic involvement of regional nodes and the occurrence of radiation complications involving the gastro-intestinal and urinary tracts following irradiation alone for carcinoma of the cervix, the authors have done radical panhysterectomy and radical pelvic lymphadenectomy in selected cases.

This procedure has been used in 75 cases, and includes patients in the following 3 groups:

(1) Patients without previous radiotherapy.

(2) Patients with previous deep x-ray therapy alone or with radium therapy alone.

(3) Patients with complete x-ray and radium therapy or patients treated elsewhere with what was regarded by the authors as partial x-ray and radium therapy.

Clinical stages of the cervical cancer in these cases varied from I to III (League of Nations classification). Adenocarcinoma was diagnosed in 9.3 per cent and squamous-cell carcinoma in the remainder.

The most significant of postoperative complications has been urinary tract fistulae, with a total incidence of 12 per cent. Preoperative irradiation seems to predispose to occurrence of this complication postoperatively.

No immediate deaths resulted in this series of cases, and the total mortality to date is 4 per cent. All patients who developed recurrent disease did so within the first postoperative year.

The authors conclude that the majority of patients with carcinoma of the cervix uteri should be treated with the accepted technics of irradiation therapy. However, they feel that in a small percentage of patients the operation as they do it has a definite place in treatment of this condition.

Ten tables.

H. J. THOMPSON, JR., M.D.
Jefferson Medical College

Precision Dosage in Interstitial Irradiation of Cancer of the Cervix Uteri. James A. Corscaden, S. B. Gusberg, and Charlotte P. Donlan. Am. J. Roentgenol. 60: 522–534, October 1948.

A carefully worked out scheme of interstitial radium implantation is presented, designed to give a cancericidal dose to the entire pelvis. Several earlier schemes are discussed and reasons are given for adoption of the final plan. The idea is an excellent one, since such irradiation should give adequate control of the pelvic lymph nodes as well as the tumor in the uterus.

The needles are implanted in the same way in each case unless the bulk of the tumor is so large that more can be implanted, always maintaining 1 cm. spacing from any other needle.

The authors state that the technic is easily learned and that complications are few. Low-intensity needles are used for a time of 120 hours. No data on results are given, apparently because the method has not been in use long enough. Anyone interested in interstitial implantation of radium or in the treatment of uterine cancer by any other means should read the article in the original.

Fourteen illustrations, including 4 roentgenograms, 2 drawings of roentgenograms, and 4 tracings of roentgenograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

What to Do for the Cancer Patient When He Returns Home. The Role of the Radiologist. Eugene P. Pendergrass. J. A. M. A. **137:** 1585–1586, Aug. 28, 1948.

This is one of three papers presented in a panel discussion on the care of the post-hospitalized patient with cancer. The other two articles deal with the medical and psychiatric aspects.

As it concerns the radiologist, what to do for the patient with cancer when he returns home may be divided into two categories: (1) diagnostic procedures and (2) palliative therapeutic procedures.

Diagnostic procedures include the search for the cause of any symptoms which may appear following removal of a malignant tumor; the demonstration of metastases; and follow-up examination after major surgery, particularly of the stomach and colon, bones, and lungs, and neurosurgery of the head and spine.

Under palliative therapeutic procedures, the author mentions a few of the conditions that respond well to radiation: metastasis to bone; cough and dyspnea and pain in the chest; inoperable metastases and recurrences; inoperable carcinoma of the breast.

Grenz Ray (Supersoft Roentgen Ray) Therapy of Cutaneous Diseases. Seymour L. Hanfling. Arch. Dermat. & Syph. **58:** 390–397, October 1948.

Three groups of patients with various dermatoses were treated with grenz rays (supersoft roentgen rays), and the results are compared with those obtained with conventional superficial (low-voltage) roentgen radiation. In some patients grenz rays alone were used; in others one-half of the eruption was treated with conventional roentgen rays and the other half with grenz rays; in the third group only one-half the involved area was treated with grenz rays. In the group in which both forms of radiation were given, the results were slightly in favor of grenz rays.

Seventy-six series of treatments with grenz rays of 58 patients with twenty diseases of the skin produced the following results: clearing in 29, considerable improvement in 30, improvement in 8, slight improvement in 3, and no change in 6. These results are said to compare favorably with reported results of conventional roentgen therapy.

Four tables.

Radiotherapy of Keloids. Carlo Porta. Radiol. med. (Milan) **34:** 625–635, October 1948. (In Italian)

The author reports on 31 patients with keloids receiving roentgen therapy. Females predominated (19) over males (12). In 25 cases a clinical cure was obtained; 5 patients were improved; 1 not improved. The procedure consisted in the administration of 75 to 100 r (100 kv., 3 to 5 mm. Al) twice weekly up to a dose of 400 to 600 r. This treatment was repeated three or four times, with one month of rest between treatments.

The author stresses the difference between clinical cures and esthetic cures, inasmuch as one may obtain a marked flattening of the lesions but the patients may still object to their appearance.

Four illustrations; 1 table.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Keloids and Hypertrophic Scars. Harold M. Trusler and Thomas B. Bauer. Arch. Surg. **57:** 539–551, October 1948.

Keloidal growths and hypertrophic scars are difficult to distinguish microscopically. In susceptible persons they follow trauma to the dermis. In addition to a primary susceptibility, other factors influencing their formation are cutaneous wounds which cross flexion creases, wounds that heal under tension, and broad defects with delayed healing. Since it is impossible to foresee their development, the authors keep all scars under observation for three months. Pressure to the scar will prevent keloid formation in many cases; if it is unsuccessful, roentgen therapy is given. For a growth already present, excision within the borders of the keloid followed by pressure and irradiation is preferred. In some cases, fractional excision may be em-

ployed to advantage. The irradiation technic must be such that no permanent damage is done, but the details are left to the individual radiologist, as there is wide divergence of opinion as to the optimum dosage and technic. The importance of successful skin grafting in the prevention and treatment of keloids is given particular emphasis.

Twenty-three photographs.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Removal of Superfluous Hair by X-Rays. D. E. H. Cleveland. Canad. M. A. J. **59:** 374–377, October 1948.

The author presents an interesting review of his investigation of the operations of a commercial institution which prescribed "radiation therapy" for the removal of superfluous hair. By his persistent investigation, the seventeen-year practice of this public health menace was finally terminated by legal action.

Four illustrative cases of malignant skin changes following treatment by the method employed are presented, one necessitating amputation and one terminating fatally. Despite similar unfavorable results, this practice is still being widely used in many localities.

It is the present opinion of dermatologists and roentgenologists that superfluous hair cannot be permanently removed with radiation of any kind, regardless of technic, without permanent injury to the skin.

Two photographs. ROBERT H. LEAMING, M.D.
Jefferson Medical College

Use of Roentgen Therapy for Retinal Diseases Characterized by New-Formed Blood Vessels (Eales's Disease; Retinitis Proliferans). A Preliminary Report. Jack S. Guyton and Algernon B. Reese. Arch. Ophth. **40:** 389–407, October 1948.

Intensive roentgen therapy to the posterior ocular segment was given during an eighteen-month period in a series of patients with ocular diseases characterized by retinal and vitreous hemorrhages and by new-formed blood vessels and fibrous tissue extending from the retina or disk into the vitreous (retinitis proliferans).

A total of 22 eyes in 14 patients were treated. The ocular condition was classified as typical Eales's disease in 8 patients; atypical Eales's disease in 4 patients, and diabetic retinitis proliferans in 2 patients.

The irradiation technic described by Martin and Reese in 1936 (Arch. Ophth. **16:** 733, 1936) and subsequently (Arch. Ophth. **33:** 429, 1945. Abst. in Radiology **46:** 542, 1946) for the treatment of retinoblastoma was utilized to avoid damage to the anterior ocular segment. A total dose of 3,500 to 15,000 r (in air) was given each eye treated. Doses of approximately 6,000 r are probably optimal.

Depending on the dose of roentgen radiation, there was moderate to complete collapse of new-formed vessels, with variable regression of fibrosis. With a single exception, there has been no recurrent hemorrhage following treatment in the 8 cases of typical Eales's disease, an effect which has appeared to be of immediate significance, but the permanency of which is not yet established. In the 2 patients with diabetic retinitis proliferans, hemorrhages have continued to appear since treatment, and permanent beneficial results can hardly be expected.

Twenty-two illustrations (2 color plates); 1 table.

Treatment of Thyroiditis. George Crile, Jr. Arch. Surg. **57:** 443–449, October 1948.

Crile separates thyroiditis into three distinct clinical types: (1) the subacute (pseudotuberous or giant-cell) variety; (2) struma lymphomatosa (Hashimoto's thyroiditis); (3) Riedel's struma.

Subacute thyroiditis is a self-limited disease of unknown causation. The preferred treatment is x-ray therapy; 600–800 r usually leads to resolution in a few weeks. While thyroidectomy will control the local disease, it is not recommended.

Struma lymphomatosa is a progressive disease of the thyroid, possibly associated with systemic disorders. Acidophilic degeneration of the epithelial elements of the thyroid is followed by replacement with lymphoid or fibrous tissue. Hypothyroidism or a peculiar hypometabolism that fails to respond to treatment with thyroid is likely to develop. The cause is unknown. While roentgen therapy has been little used in the condition, the author obtained good results in 2 cases so treated (700 r in one; 1,550 r divided into 8 treatments in the other). Good local results may also be obtained by thyroidectomy, and this treatment is recommended in cases not specifically diagnosed before operation. Neither form of treatment corrects the hypometabolism.

Riedel's struma is a chronic proliferating fibrosing inflammatory process which involves one or more lobes of the thyroid and may extend into the trachea, muscles, fascia, nerves, and vessels of the vicinity. It produces a bulky tumor, often indistinguishable preoperatively from carcinoma. The cause is unknown, but women are more often affected than men, and the condition is more common after fifty. The author has found x-ray therapy to have little effect. Operative removal may be difficult or impossible, but since a degenerating adenoma is often at the center of the mass, a simple intracapsular enucleating of this may produce striking benefit. In other cases, conservative surgical management for the relief of pressure symptoms is indicated.

[A very interesting and significant paper.—L.G.J.]

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Radiation Therapy of Tonsils and Adenoids. Erich M. Uhlmann, Philip Rosenblum, and Samuel J. Perlman. Arch. Pediat. **65:** 532–545, October 1948.

A series of 480 patients treated between February 1938 and December 1942 with deep therapy to the pharynx for enlarged or infected tonsils or hypertrophic lymphoid tissue in the nasopharynx and mesopharynx was followed, and the results are analyzed. Radiation was used because surgery was either temporarily or permanently contraindicated.

The technical factors were 200 kv., 0.5 mm. copper and 1.0 mm. aluminum filter, 10 ma., and 50 cm. distance. Two fields were used, and individual doses ranged from 75 to 150 r per field. Each port was treated at each session, and treatment was repeated weekly for a total of 3 doses. If cervical nodes were involved, the neck was included in the field.

Of the entire group treated, 70 per cent were either markedly improved or completely relieved of symptoms; 17 per cent showed slight improvement, and the rest, none. Many of the failures were apparently in allergic types, not good prospects for any form of therapy.

Three tables. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

RADIOACTIVE ISOTOPES

Preparation and Measurement of Isotopes and Some of Their Medical Aspects. Supplement to the United States Naval Medical Bulletin, March–April 1948, pp. 1–216.

Space is not available for abstracting all of the articles which make up this supplement to the *Naval Medical Bulletin* nor does this seem to be necessary, since much of the material has been covered in articles previously abstracted. The titles of the papers and the authors will give a fairly comprehensive idea of the material covered: Introductory Remarks, Harold C. Urey; Fundamentals of Isotope Separation, Karl Cohen; Application of Radioisotopes to Problems of Naval Medicine, Robert Emrie Smith; Thermal Diffusion and Other Physical Methods of Isotope Separation, William W. Watson; Pile Production of Radioactive Isotopes, Waldo E. Cohn; Production of Radioactive Isotopes by the Cyclotron and Other Methods, John W. Irvine, Jr.; A New Mass Spectrometer for Isotope-Ratio Measurements, Harold W. Washburn; Preparation of Gas Samples for Mass Spectrometric Analysis of Isotope Abundance, David B. Sprinson and David Rittenberg; Synopsis of Basic Ideas in the Theory of Radioactivity and Detection of Radiation, Richard D. Present; Determination of Hard Radiation, Including Preparation of Samples, William F. Bale; Determination of Soft Radiation, Including Preparation of Samples, Arthur K. Solomon; Detection of Intermediates, Criteria of Purity, Martin D. Kamen; The Radioautographic Technique, Dorothy J. Axelrod and Joseph G. Hamilton; Hazards Presented by Radioactive Materials and How to Cope With Them, Karl Z. Morgan; Dosage Levels in Administration of Isotopes to Animals and Man, Hermann Lisco; Laboratory Handling of Radioactive Material, Protection of Personnel and Equipment, Paul C. Tompkins; An Illustration of the Power of Isotopes in a Biochemical Problem, Vincent du Vigneaud; Medical Aspects of an Atomic Disaster Plan, E. Richard King; Chemical Methods of Isotope Separation, Allen F. Reid.

Use of Radioiodine in the Treatment of Exophthalmic Goiter. Samuel F. Haines, F. Raymond Keating, Jr., Marschelle H. Power, Marvin M. D. Williams, and Mavis P. Kelsey. J. Clin. Endocrinol. **8:** 813–825, October 1948.

This is a report on 40 patients who were treated with radioiodine for exophthalmic goiter at the Mayo Clinic between September 1946 and February 1948. Patients in whom the clinical diagnosis was adenomatous goiter with hyperthyroidism constitute a separate group so far as collection of I^{131} and other problems of treatment are concerned. Cases of exophthalmic goiter with adenoma are included.

Of the 40 patients, 13 were men and 27 women. The average age of the men was 45.9 years and of the women 52.0 years. Twenty-eight of the patients had recurrent exophthalmic goiter, and from one to four attempts had been made to control the disease by surgical resection. In some instances the presence of one paralyzed vocal cord in a patient with a considerable quantity of thyroid tissue on the opposite side was the chief reason for deciding on treatment with I^{131}. Seventeen patients had serious heart disease and in some of these recurrent exophthalmic goiter was present.

A result was considered good if the basal metabolic rate was lowered to plus 15 per cent or further and if the clinical evidence indicated that the patient was in a euthyroid state. Results were classified as fair when the severity of the hyperthyroidism was markedly reduced by treatment. Good results were obtained by the administration of one therapeutic dose of I^{131} in 27 of the 40 cases. In all these patients the clinical evidences of hyperthyroidism were completely controlled by the treatment and in all but one the size of the thyroid was reduced to, or nearly to, normal. Myxedema developed in 7 patients, and in these treatment with desiccated thyroid was instituted. It is not known whether the myxedema is permanent. Results were fair in 8 cases. These patients showed a significant improvement after the first dose of I^{131}, and in 4 a second therapeutic dose resulted in complete control of hyperthyroidism. Poor results were recorded in 5 cases in this series. In 1 patient a second dose produced fair results.

The average dose of I^{131} in patients who obtained good results from a single dose was 242 microcuries per gram of thyroid tissue; in those who obtained fair results, 239 microcuries per gram; and in those who had poor results, 151 microcuries per gram. The authors believe, therefore, that an average dose of more than 200 microcuries per gram of thyroid tissue should be tried in cases in which an attempt is made to control the disease with a single dose; some patients treated in this way will need a second dose of I^{131}. The incidence of both myxedema and of recurrence of exophthalmic goiter after treatment was much higher among the patients in this series treated with I^{131} than among patients treated surgically.

No serious reactions were noted by any of the patients. One had a mild febrile reaction associated with nausea for four days; this began two days after the administration of I^{131}. The basal metabolic rate rose from plus 46 to plus 62 per cent. It is impossible to say whether this represented a mild radiation sickness or a mild hyperthyroid reaction or both. It was common for the thyroid gland to become hard and slightly tender a few days or a week after a therapeutic dose and for the basal metabolic rate to rise slightly above pretreatment levels for a few days. It is too early to determine whether late reactions of any type may occur. One patient in the series has become pregnant since receiving I^{131}.

Effect of Total Thyroidectomy on the Function of Metastatic Thyroid Cancer. Rulon W. Rawson, L. D. Marinelli, Bengt N. Skanse, Jack Trunnell, and Rex G. Fluharty. J. Clin. Endocrinol. **8:** 826–841, October 1948.

The normal thyroid was removed surgically or destroyed by large doses of radioactive iodine in 21 patients having relative or absolute non-functioning metastatic thyroid cancer (4 papillary adenocarcinomas, 13 solid and/or follicular adenocarcinomas, 3 giant-cell carcinomas, and 1 Hürthle-cell adenocarcinoma).

Eight of the metastatic solid and/or follicular adenocarcinomas assumed the capacity to concentrate radioactive iodine after the normal thyroid was removed. The time required to observe these changes varied between one and thirty-two months. One patient having a solid adenocarcinoma, whose metastatic tumor failed to collect iodine even after the development of myxe-

dema, was found to concentrate in her metastatic lesion a significant amount of radioiodine after treatment with thyroid-stimulating hormone.

In the 4 cases of papillary adenocarcinoma the authors failed to demonstrate any iodine-concentrating function of the metastatic lesions.

The 3 patients with giant-cell carcinoma died within six months after thyroidectomy and before any change in the function of the metastasis could be demonstrated.

The one patient with metastatic Hürthle-cell adenocarcinoma was still being followed at the time of the report and had thus far shown no change in function in the metastasis.

Five photomicrographs; 6 charts; 1 table.

EXPERIMENTAL STUDIES

Response of Tissue to Total Body Irradiation. John L. Tullis. Naval Medical Research Institute, National Naval Medical Center, Bethesda, Md., Project NM 007 039, Report No. 11, July 1948.

This paper deals with the biological effects of irradiation from the atomic bomb explosions at Bikini, in the summer of 1946, and an experimental group of animals treated with million-volt x-rays.

The lesions produced in swine by exposure of the total body to ionizing radiations from the atomic bomb are indistinguishable from lesions produced by exposure of the total body to million-volt x-irradiation. These lesions are characterized by hemorrhage, necrosis and secondary infections. Lymphoid cells, myeloblasts, erythroblasts, germ cells, and intestinal epithelium are found to be quite radiosensitive. Injury to these cells caused anemia and lowering of body resistance to infection.

Irradiation caused dilatation of capillaries, impairment of circulation, and tissue anoxia. Anemia enhances both lowered resistance to infection and anoxia, and thus the pathological physiology becomes self-perpetuating. Absorption of toxic substances through the injured intestinal mucosa and accumulation of the tissue break-down products in the blood stream are phenomena which logically might follow the widespread necrosis that occurs after total body irradiation. There is, however, no chemical proof or histologic evidence of toxemia from either of these sources.

Since the most primitive hematopoietic stem cells, the reticular cells, are relatively radioresistant, the efforts to reduce mortality do not seem altogether hopeless. Management of total body radiation disease should be directed toward prevention of secondary infections, treatment of anemia, impaired circulation and anoxia.

This article is accompanied by gross photographs of the lesions produced in swine, as well as photomicrographs. It is well worth the perusal of anyone interested in the effects of irradiation.

Thirty-six illustrations; 1 table.

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Palo Alto, Calif.

Frequency of Transmitted Chromosome Alterations and Gene Mutations Induced by Atomic Bomb Radiation in Maize. E. G. Anderson. Proc. Nat. Acad. Sciences **34:** 387–390, August 1948.

This paper represents a study of the effect of the atomic bomb radiation at Operation Crossroads. It was found that when maize was subjected to roentgen irradiation, 15,000 r produced effects equivalent to those of the radiation from the atomic bomb. The frequencies of chromosome alterations and gene mutations were roughly equivalent to the frequencies obtained at Bikini.

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Growth in Tissue Culture of Analogous Mouse Mammary Carcinomas and Their Response to Radiation. Anna Goldfeder and Gladys Cameron. Cancer Research **8:** 465–471, October 1948.

A comparison was made of the growth characteristics *in vitro* of two analogous mammary tumors of inbred strains of mice, C3H and dba, and the relative response of these tumors to x-radiation. These observations, or others exactly similar, have been reported by the senior author in Radiology **52:** 230, 1949.

Seven photomicrographs.

Resuscitation of Heat-Inactivated Seeds with X-Radiation. Richard S. Caldecott and Luther Smith. J. Heredity **39:** 195–198, July 1948.

The authors offer a preliminary report on experiments to determine the effect of pre- and post-irradiation on seeds, in combination with barely lethal heat treatments. These tests were done on barley and einkorn.

The x-ray treatment of dormant seeds of barley, immediately after they had been given a "lethal" heat treatment, resulted in resuscitation of 90 per cent or more. This result was obtained over a considerable range of x-ray dosages (12,000 to 36,000 r). Seeds which were x-rayed before they were given a "lethal" heat treatment were protected from heat inactivation by some relatively low and high x-ray dosages, but not by intermediate dosages [no explanation for this inconsistency is given]. The mean survival of barley seeds given a "lethal" heat treatment and then irradiated was greater than the mean survival of seeds which received irradiation only. In this sense, heat treatment also protected seeds from irradiation, just as in some other combinations of treatment, x-radiation protected the seeds from injury by heat.

The data presented did not appear to substantiate the hypothesis that the killing effect of heat is due simply to coagulation of protoplasmic proteins.

One graph; 2 tables.

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